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ABSTRACT

This report presents a process for identifying emerging and significantly evolving occupations within key Texas industries. It explains findings of a research project that provided a current information resource to help job seekers make informed career and training choices. Chapter 1 is an introduction. Chapter 2 examines the projected mismatch between work force capabilities and needs and the reality of workplace change. Chapter 3 presents results of an industry analysis with an explanation of the variables used to determine employment growth and job quality potential. It examines two of the most significant driving forces behind industry change--consumer demand and technological innovation. Chapters 4-10 examine each targeted industry or industrial grouping in detail, discussing specific technological innovations and specialty areas. Each chapter opens with a brief, one-page summary highlighting the chapter's most important findings and lists the emerging and evolving occupations related to that industry or industry grouping. The industries and industrial groupings are as follows: electronics, electrical equipment, and semiconductors; financial services; professional services; telecommunications; transportation; utilities; and wholesale trade--durable goods. Chapter 11 presents conclusions and recommendations. (Contains 76 references. Appendixes include methodology; step-by-step replication manual; complete industry analysis listing; and detailed results from analyses of Texas and Florida follow-up.) (YLB)

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EMERGING AND EVOLVING OCCUPATIONS IN TEXAS

A DESCRIPTIVE ANALYSIS OF THIRTEEN TARGETED INDUSTRIES IN TEXAS WITH LISTINGS OF EMERGING AND SIGNIFICANTLY EVOLVING OCCUPATIONS

June 1996

Developed by the Texas State Occupational Information Coordinating Committee for Students, Job-Seekers, Workforce Development Professionals, and Educators

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All staff at the Texas State Occupational Information Coordinating Committee (SOICC) contributed as a team to the completion of this report. In particular, Richard Froeschle, Executive Director of the Texas SOICC, and Marc Anderberg, Director of the Automated Student and Adult Learner Follow-Up Project, developed the original vision of this project and both contributed enormously to the planning and writing of the research methodology and the final report. Ruben Garcia developed several data reports integral to the industry analysis section of the report. Colin Atobajeun and Jon Hochberg both assisted with initial database development needs. Robert Westlund facilitated the development of the electronic forum. Gary Tucker designed the report cover.

Terry Ramsey
Project Director

EXECUTIVE SUMMARY

This report presents a process for identifying emerging and significantly evolving occupations within key Texas industries and explains our research findings to date. The goal of the project is to provide a current information resource to help students and adult job-seekers make informed career and training choices. In particular, this report targets individuals who plan to pursue an associate degree, skill certification, or an alternative training program other than a four-year baccalaureate degree.

Throughout the course of this year we identified thirteen key industries in Texas promising employment growth and good job quality. Within these thirteen industries we identified thirty-six specific titles and fourteen clusters of emerging and significantly evolving occupations. This list of emerging and evolving occupations is not intended to be exhaustive of every career option available; rather, it is a guide to the most promising emerging and evolving non-baccalaureate career choices in Texas. The key industries are analyzed in Chapters Four through Ten. These chapters may suggest to the reader other occupations within these key industries that may be of interest or for which the reader has some background, familiarity, or expertise. For more information about occupational titles within these thirteen industries, information about education and training programs, and information about local employers within these industries, readers are encouraged to consult a career guidance counselor, the career center at a local community or technical college, a local *One-Stop Career Center*, or a local *Workforce Development Board*.

How to Use This Report

This report is an important addition to career guidance libraries and as a counseling tool for career guidance and workforce development professionals as they help students and adult job-seekers explore various career options. It can assist educators and trainers in revising and updating their training programs to keep pace with technological innovation. This report also can be used by communities as an economic development tool. Local labor market analysts can adapt the research design in Appendix A and the step-by-step replication guide in Appendix B to develop a locally-relevant list of targeted industries and occupations. Communities can then assess their strengths and resources in terms of their key industries and occupations. A community with employers in one or more key industries may be able to leverage funds to revise existing training programs or develop new ones to prepare workers for employment in these industries. A community also can cite the findings in this report or their own replication studies to highlight its strengths in terms of local industry and a skilled workforce base to market itself to potential businesses.

Report Overview

Chapter One of this report introduces and sets the stage for the rest of the report. Chapter Two underscores the importance of informed career exploration by examining the projected mismatch between workforce capabilities and needs and the reality of workplace change. Chapter Three presents the results of our industry analysis with an explanation of the variables used to determine employment growth and job quality potential. This chapter also examines two of the most significant driving forces behind industry change--consumer demand and technological innovation. Chapters Four through Ten examine each targeted industry or industrial grouping in detail, discussing specific technological innovations and specialty areas. Each of these seven chapters opens with a brief, one-page summary highlighting the chapter's most important findings and lists the emerging and evolving occupations related to that industry or industry grouping. Chapter Eleven presents conclusions and recommendations. The following table summarizes this year's findings.

INDUSTRY	ASSOCIATED EMERGING AND EVOLVING OCCUPATIONS
These 6 clusters of emerging and evolving occupations span all thirteen targeted industries.	**Computer Networking Technician** Also listed as Applications/Software Installer, Computer Installer, Computer Network/LAN/WAN Administrator, Computer Security Technician, Electronic Mail Technician, Internet Services Technician, Systems Support Technician, and Webmaster. **Computer Programmer** Also listed as Object-Oriented Computer Programmer. **Computer Support Technician** Also listed as Computer Help-Desk Worker, Hardware/Software Technical Support, and Microcomputer User Support Specialist. **Customer Support Specialist** Also listed as Customer Service Representative, Customer Support Staff, Information Services Clerk, and Information Specialist. **Data/Information Specialist** Also listed as Data Communications Technician, Data Encryption Specialist, Database Administrator, Imaging Technician, Massive Data Storage Technician, Real-Time Document Sharing Technician, and Wireless Data Transmission Technician.
Targeted Industry in the Manufacturing Sector-- **ELECTRONICS, ELECTRICAL EQUIPMENT, AND SEMICONDUCTORS** + **Emerging and Evolving Occupations within this industry**	**Semiconductor Technician/Operator** Also listed as Chemical Vapor Deposition Technician, Diffusion/Doping Technician, Dry Etch Technician, Ion Implant Technician, Laser Technician, Oxidation Technician, Packing Technician, Photolithography/Microlithography Technician, Photonics Technician/Electro-Optical Technician, Process Technician, Thin Films Technician, Wafer Preparation Technician, and Wet Etch Technician. **Other Industry Occupational Areas:** Automation/Robotics Technician Circuit Card Tester High-Density Energy Battery Technician High-Density Television Technician Manufacturing Technician/Production Technician Microwave Technician Miniaturization Technician

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INDUSTRY	ASSOCIATED EMERGING AND EVOLVING OCCUPATIONS
Targeted Industries in the Financial Services Sector-- **DEPOSITORY INSTITUTIONS, NONDEPOSITORY INSTITUTIONS, HOLDING AND INVESTMENT OFFICES, AND INSURANCE SERVICES** + **Emerging and Evolving Occupations within these industries**	**Banking**: Automatic Teller Machine Servicer/Clerk Global Representative **Insurance**: Compliance Officer/Utilization Review Coordinator Insurance Claims Clerk Medical Eligibles Specialist Provider Relations Representative Reimbursement Specialist
Targeted Industries in the Professional Services Sector-- **ENGINEERING, ACCOUNTING, RESEARCH, MANAGEMENT, LEGAL SERVICES, AND OTHER RELATED SERVICES** + **Emerging and Evolving Occupations within these industries**	**Industry Occupational Areas:** Data Acquisition and Verification Technician Electronic Research Technician Litigation Support Specialist Meeting/Event Planner Phone Poller/Interviewer
Targeted Industry in the Telecommunications Sector-- **COMMUNICATIONS** + **Emerging and Evolving Occupations within these industries**	**Multimedia Specialist** Also listed as Computer Graphics Technician, Desk Top Publishing Specialist/Operator, Multimedia Software Designer, Multimedia Specialist, Plug and Play Internet Application Developer, and Print and Graphics Imaging Technician. **Wireless Communications Technician** Also listed as Cellular Phone Installer, Cellular Technician, Personal Communications Services Specialist, Radio Communications Technician, and Wireless Data Transmissions Technician. **Other Industry Occupational Areas:** Carrier Frame Relay Services Specialist Direct Broadcast Service Satellite Technician Fiber Optics Technician Videoserver Technician

INDUSTRY	ASSOCIATED EMERGING AND EVOLVING OCCUPATIONS
Targeted Industries in the Trade and Transportation Sectors-- **WHOLESALE TRADE, AIR TRANSPORTATION, AND WATER TRANSPORTATION** + **Emerging and Evolving Occupations within these industries**	**Navigation/Mapping/Surveying Specialist** Also called Geographic Information System (GIS) Specialist, GIS Cadastralist, and Global Positioning System Technician. **Other Industry Occupational Area:** Inventory/Warehousing/Logistics Specialist **Air Transport Technician** Aviation Mechanic Avionics Technician Noise Abatement Technician
Targeted Industry in the Energy, Utilities, and Conservation Sectors-- **ELECTRICITY, GAS, AND SANITATION SERVICES** + **Emerging and Evolving Occupations within these industries**	**Industry Occupational Areas:** Air Monitoring/Emissions Technician Alternative Fuels Technician/Hybrid Fuel Technician Chemical Safety Technician Decontamination Technician Environmental Quality Specialist Hazardous Materials Removal Worker Home Energy Efficiency Auditor Reclamation/Reuse Technician Utilities Plant Technician/Operator Water Quality Specialist **Other Major Industry Occupational Clusters:** Energy Conservation Recycling and Restoration Remediation of Environmental Contamination Renewable Energies Solid and Hazardous Waste Management

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CHAPTER ONE:
INTRODUCTION

It seems lately that everywhere we turn we are bombarded by information about jobs--how to predict the top jobs of the future, how to get one of these jobs, how to keep the job, what to do if you lose the job and have to find or train for a new one. News reports, talk shows, and best selling books all offer opinions about these topics. It is easy to find self-identified experts willing to espouse their visions of a gloom and doom future with only low skill and low paying jobs for most of us. But other analysts present a more promising vision of the future where technology and consumer demands will create new jobs and the need for new skills. In this future any individual can reap the benefits of a high quality, high wage job by investing in training and technological skill development and by maintaining an openness to workplace change. While there will continue to be discussions about the nature of work in the future, it is quite clear there will still be work to be done. The more important questions seem to be predicting what this future work will be and what training will provide the best preparation to compete for these jobs.

In particular, junior high and high school students require information about future jobs that will help them plan their education, whether it is obtained at a vocational training school, a community or technical college, a four year postsecondary institution, or some other training program. Other adult job-seekers, dislocated workers, and clients of public assistance programs need information to help them make informed career choices and select appropriate training programs. Moreover, because many clients receiving public assistance usually have at most two years to complete an employment training program, their identification of a high demand job and the training program that will get them there becomes a critically important decision. Since students and adult job-seekers are ultimately responsible for their own decisions about education and training, they often seek the advice of career counselors, educators, and labor market analysts; these professionals also need easily accessible and up-to-date information about future jobs.

Many career guidance sources offer pieces of seemingly helpful information but rarely present the whole picture. Scanning this literature, one can easily locate a multitude of articles citing their own list of "hot" occupations,[1] industries,[2] or technologies. But many of these lists are overly simplistic and contain neither methodological information about how the list was derived nor descriptive information about the items included. To be most useful to students and adult job-seekers planning their career and training investment, information about future jobs must include an objective and empirical foundation as well as contextual descriptions of the items included. Neither is completely helpful alone but combined they can be a powerful source of information.

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[1] In this context, an occupation is simply another term for a job. The Dictionary of Occupational Titles (DOT) contains titles and descriptions of the most common occupations in the United States. The Occupational Employment Statistics Handbook (OES) contains employment levels and wage data for these common occupations, and is updated through surveys of employers every three years. The OES establishes a hierarchical coding structure for every occupational title--five digits are used to represent four levels of classification and detail. At the simplest level, OES codes range from 1 to 9 in the following manner: 1 is Managerial and Administrative; 2 is Professional, Paraprofessional, and Technical; 3 is Teachers, Educators, Librarians, and Related Workers, 4 is Sales and Related Occupations; 5 is Clerical and Administrative Support; 6 is Service Occupations; 7 is Agricultural, Forestry, Fishing, and Related Occupations; 8 is Production, Construction, Operating, Maintenance, and Material Handling Occupations; and 9 is Machine Setters, Set-Up Operators, Operators, and Tenders. Each occupation at the 1-digit OES level can be expanded to the 5-digit level, with each successive digit adding more precision about the actual occupation. For instance, while OES 2 includes (continued...)

Project Overview

This report is the first in a series of three over a three year time span, with each successive report building on the previous one. This first report identifies and describes thirteen industries in Texas exhibiting strong predicted employment growth and job quality--hereinafter referred to as targeted industries--and lists associated emerging and evolving occupations. (For this project we defined emerging occupations as occupational titles new to the standard coding structures. These occupations may require the development of completely new training programs. Evolving occupations are those occupations with rapidly changing requisite skills and competencies. These occupations may require the updating or revision of existing training programs.[3]) Next year's report will examine in detail the emerging and evolving occupations associated with these targeted industries and include information on required skills and competencies. The third report will document the full implementation of the project methodology with an automated bridge from

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[1](...continued)
all Professional, Paraprofessional, and Technical Workers, OES 21 is General Management Support, OES 211 is Accountants, Auditors, and other Financial Specialists, and OES 21111 is Tax Preparers. A library or local workforce development planning and/or training agency can provide assistance in locating a copy of the OES Handbook.

[2] An industry is simply a broad collection of employers producing similar goods and services. The Standard Industrial Classification (SIC) Manual created a hierarchical coding structure for industries in the United States which becomes more detailed with each added digit. The SIC Manual was developed to classify establishments by type of activity in order to collect, aggregate, and analyze economic and business data. At the simplest and broadest level, SIC codes range in divisions from A to J. Each division includes industries classified at the 1-digit level, 2-digit level, 3-digit, and 4-digit level. Division A is Agriculture, Forestry, and Fishing and can be thought of as SIC 0. Division B is Mining and can be thought of as SIC 1. Division C is Construction and also includes industries beginning with SIC 1. Division D is Manufacturing and includes industries beginning with SICs 2 and 3. Division E is Transportation, Communications, Electric, Gas, and Sanitary Services and includes industries beginning with SIC 4. Division F is Wholesale Trade and includes SIC 5. Division G is Retail Trade and also includes SIC 5. Division H is Finance, Insurance, and Real Estate and includes SIC 6. Division I is Services and includes industries beginning with SICs 7 and 8. Division J is Public Administration (Government) and includes SIC 9. A library or local workforce development planning and/or training agency can provide assistance in locating a copy of the SIC Manual.

[3] For detailed explanation of these definitions and the research methodology, see Appendix A of this report.

targeted industries to occupations.[4] It will provide an updated and more lengthy description of emerging and significantly evolving occupations in Texas.

> ***The vision driving this multi-year project is to build an automated and continuous data-driven process for identifying emerging and significantly evolving occupations within key Texas industries. The goal is to provide a current information resource to help students and adult job-seekers make informed career and training choices as well as to help educators plan new programs and revise existing curricula.***

We developed a broad guiding methodology for this process which is presented in Appendix A. The implementation of the first part of this methodology is outlined in detail in Appendix B and is intended to serve as a step-by-step guide to replicating this process at the local level. While our ultimate goal is to identify emerging and evolving occupations, the first step in the methodology is to identify key industries showing employment growth and job quality potential. *The reason we focus first on industries is because the major factors determining occupational demand and skills requirements are tied to industry growth and the application of technologies within these industries.*

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[4] The industry-to-occupation bridge is based on job titles submitted by Texas employers to the Texas Student Follow-Up System. The Follow-Up System tracks completers and leavers of Texas education and training institutions in order to evaluate training outcomes. A portion of the project involves surveying employers of these graduates and asking about job titles, etc. When the responses to these surveys are collected, the employer-assigned job titles are matched against standardized and historic databases of occupational titles. Titles that do not match any of the commonly known occupational titles are called *residual* payroll titles. Analysis conducted this year by Duane Whitfield and Jay Pfeiffer of the Florida Education and Training Placement Information Program (FETPIP), subcontractors to this project, developed several key recommendations for revising the Texas SOICC Follow-Up System's data collection process in order to use residual payroll titles as a guide to identifying emerging occupations. Since residual titles do not match current coding systems, there is a likelihood they are new titles signifying new jobs. Use of residual payroll titles, along with other sources, can serve as an automated and data-driven bridge from industries to occupations. The recommended changes to the Follow-Up System will be implemented during the next phase of this project, with the results available for the third year's report. See the Texas SOICC's 1995 Final Report on the Texas Automated Student and Adult Learner Follow-Up System for a detailed explanation of the Texas Follow-Up System, as well as the 1996 report by Duane Whitfield and Jay Pfeiffer, New and Emerging Occupational Titles: Using Automated Follow-Up Employer Payroll Titles.

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CHAPTER TWO:
THE IMPORTANCE OF INFORMED CAREER CHOICE

While so much of the career guidance and employment outlook literature predicts a gloom and doom picture of the future of work, there is an important flip-side to this perspective. With an awareness of the predicted gap between worker capabilities and employer needs and a willingness to invest in training to close this gap and keep pace with technological innovation, any individual can find good employment and thereby benefit from these workplace changes.

Predicted Mismatch Between Workplace Capabilities and Workplace Needs

So many of us bury our heads in the sand and think that if we just keep on doing what we have been doing, we will be fine. But the reality we live in can be alarming.[5] A 1994 study commissioned by the Public Relations Society of America developed predictions about the future of the workplace based on demographic data and trend analysis.[6] The United States will see an increased mismatch between workplace capabilities and workplace needs.

Workplace/Worker Supply

- An estimated 3-4 million adults have serious problems with basic skills.
- Another 20-30 million adults (about 20%) have not mastered basic skills well enough to function effectively in the work environment.

Workplace/Employer Demand

- Forty-one percent of jobs created through the end of the century will be "high skill", (versus 24% today).
- By 2000, a majority of all new jobs will require postsecondary education, up from a third today.
- The fastest growing jobs will be in professional, technical, and sales fields requiring the highest education and skill levels.
- Still, 70% of all jobs in the US will not require a college degree.

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[5] Jeremy Rifkin, The End of Work. (New York, New York, 1995)

[6] Rick Fischer, "Tomorrow's Workforce, Predictions, Projections, and Implications," Public Relations Quarterly (Spring 1995)

- Manufacturing jobs will account for less than 17% of all jobs by 2000 (down from 30% in 1955).
- Eighty-eight percent of workers will be in the service sector (up from 67% in 1980).

The implications of these predictions mean the pressure to increase productivity will intensify, organizations will seek to substitute technology for people as productivity gains become more difficult, and organizations may experiment even more with different management structures and job- and time-sharing arrangements. As employers struggle to keep their place in the global economy, they will try to maximize productivity by optimizing the mix of labor and technology, plant, equipment, and other capital expenditures. This search for greater productivity and increased revenues will have a significant impact on the demand for particular labor skills--resulting often in evolving and emerging worker skill requirements.

Workplace Change Results in the Need for Emerging and Evolving Occupational Skills

According to the federal Bureau of Labor Statistics, between 1990 and 2005 there will be faster rates of employment growth for occupations requiring higher levels of education and slower rates for those requiring less formal education.[7]

- Administrative and managerial occupations will increase by 27% between 1990 and 2005.
- Professional specialty occupations will increase by 32%.
- Employment in technology-related fields will increase by 37%--the highest growth rate for any group.
- Manual labor positions will decline by 40%.

Low-skilled jobs have been in relative decline for many years and can be expected to continue to do so. The growth of part-time employment is expected to continue. Outsourcing and contracting for services also appear to bea trends that will persist and increase. Interactive video-conferencing may add further impetus to this trend, since knowledge-based service professionals will be able to serve larger and more geographically diverse markets.[8]

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[7] Congress, Senate, Subcommittee on Children, Family, Drugs, and Alcoholism of the Committee on Labor and Human Resources, Preparing for the Economy of the 21st Century, 102nd Congress, 2nd session, March 5 and 10, 1992.

[8] Australian National Board of Employment, Education, and Training--Employment and Skills Formation Council, Converging Communications and Computer Technologies: Implications for Australia's Future Employment and Skills (Australia: Australian National Board of Employment, Education, and Training, February 28, 1995).

Although it can be frightening to see industry sectors like Manufacturing that traditionally offered good employment become less stable, other sectors like Electronics and Telecommunications are employment bonanzas. Where new technologies replace workers in one sector, new sectors emerge creating new jobs and the need for new skills. Although we may not like to admit it, all of us are in jobs and careers that are in transition. For some, our job titles will remain the same while the associated duties and skills will change. For others, there will be new job titles with new duties and skill requirements.[9]

The most significantly growing sector across all industries is the knowledge sector. High knowledge industries have accounted for 43% of net employment growth since 1990. Special skills and capabilities have moved from being the way to win to being the price of admission. In this age of downsizing and rightsizing, the best jobs will be found in industries where knowledge counts. Specific skills and competencies will be required just to get in the door. More and more, the industries producing the best jobs are those that require a high knowledge base of its workers. These jobs are the best jobs--offering greater stability and high wages.[10]

> ***One category of this knowledge-based workforce will be technicians. Although technicians and technical workers may not have earned a four-year college degree, they are likely to have a vocational-technical education background which increasingly includes two years of community college. The necessity of workers with a technical education is growing dramatically. Associate degree holders can find solid employment with top corporations earning good pay. The gap between associate-degree holders and high school dropouts is more than $1,000 a month. And this trend will increase as a greater percentage of jobs require technical skills. This new breed of worker will be highly skilled, extremely computer literate, and conversant with many of the advances in manufacturing technology from numerically-controlled machine tools to robotics. Industry experts predict these workers will play a central role in the future of U.S. competitiveness in global markets.***[11]

The increasing use of sophisticated technology and consumers' demand for efficient and flexible goods and services are rapidly changing the way Americans work. The workplace is being reshaped by new corporate organizational arrangements. As corporate America responds to consumers and technology, there will be flatter organizations with more independent units and fewer layers of bureaucracy between executives and line workers. The workplace will be organized around task forces and peer groups. These new organizational arrangements mean that workers will need to be trained differently. Skill requirements are changing dramatically and increasingly require independent judgement as well as analytical and interpersonal skills.[12] Employees in this type of work setting will require more than just basic analytic or even specialty skills. They also will need training in communication and collaborative settings, where the emphasis will be on a group rather than on the individual.[13]

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[9] Norman S. Feingold and Maxine H. Atwater, New Emerging Careers, Today, Tomorrow, and in the 21st Century (Garrett Park, MD: Garrett Park Press, 1988). Only rarely do changes in technology or consumer demand result in the need for entirely new, or emerging, occupations. More often, market changes necessitate the upgrading of skills and competencies required for existing, or evolving, occupations.

[10] James Aley, "Where the Jobs Are," Fortune (September 18, 1995).

[11] Congress, Senate, Subcommittee on Children, Family, Drugs, and Alcoholism of the Committee on Labor and Human Resources, Preparing for the Economy of the 21st Century, 102nd Congress, 2nd session, March 5 and 10, 1992.

Given these implications, it is critical for all of us to be actively planning our employment futures, regardless of whether we are currently employed or planning our education and training investment. Career planning must be based on the most current information available about predicted employment growth and job quality. The need for sound data about emerging and evolving occupations is especially critical to those students just beginning their secondary education and training.

> ***A student entering the training pipeline through career exploration in the eighth or ninth grade may take a minimum of six years to exit with an associate degree--longer if they pursue a baccalaureate degree or do not move through their postsecondary education and training at the fastest pace possible because they must work part-time during school. Given today's rate of change, the world of work surely will look very different when they do exit the training pipeline and expect to embark upon a career. Without sound long-range planning and effective delivery of labor market information into their hands, we will engender false expectations leading to disappointment and frustration.***

Career guidance information that places labor market data within a broad contextual framework can help students, adult job-seekers, and workers investing in professional development make informed career and training decisions. The following chapter presents the top thirteen industries in Texas promising both strong employment growth and job quality. These industries are predicted to have the most significant positive employment impact on the Texas economy through the year 2000.

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[12] Congress, Senate, Subcommittee on Children, Family, Drugs, and Alcoholism of the Committee on Labor and Human Resources, Preparing for the Economy of the 21st Century, 102nd Congress, 2nd session, March 5 and 10, 1992.

[13] Congress, Senate, Subcommittee on Children, Family, Drugs, and Alcoholism of the Committee on Labor and Human Resources, Preparing for the Economy of the 21st Century, 102nd Congress, 2nd session, March 5 and 10, 1992.

CHAPTER THREE: WHAT DOES ANALYSIS TELL US ABOUT INDUSTRIES IN GENERAL?

Industry Analysis

Industrial analysis is the process of prioritizing industries according to job-opening potential.[14] For this project we went one step further and added other economic criteria that will help evaluate not only job opening potential or employment demand, but also the employment *quality* of industries. The following table summarizes the findings from our industry analysis and lists in order by Standard Industrial Classification (SIC) those industries which meet at least one of two employment growth variables and at least two of the three economic competitiveness variables.[15]

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[14] Texas State Occupational Information Coordinating Committee, The Texas Economy: An Ever Changing Landscape Affects Us All! (Austin: Texas SOICC, June, 1994) and William D. Witter and Richard Froeschle, Targeting Your Labor Market: Using Labor Market Information in Planning for Texas Jobs (Austin, TX: Texas Employment Commission and Texas State Occupational Information Coordinating Committee, 1995).

[15] Appendix B explains each of the employment growth and economic competitiveness variables and outlines the step-by-step analysis used to calculate each variable. Briefly, the two employment growth indicators are predicted absolute change in employment from 1993-2000 and predicted percent change in employment from 1993-2000. Industries showing negative growth or declining employment are not included in the analysis. The percent change values standardize the absolute change values for clearer comparison of employment change across industries. To determine employment quality we identified and synthesized three economic indicators of economic competitiveness: wage rates, staffing patterns, and capital-to-labor ratio. An industry wage rate is the average weekly salary paid to individuals employed in a particular industry. An industry staffing pattern is an occupational breakdown across each 1-digit OES code of the individuals employed in that industry. For this analysis industries were selected with a high percentage of individuals employed in the OES-2, Professional, Technical, and Paraprofessional occupations. Industries with a high percentage of individuals employed in these positions tend to be the knowledge industries and so tend to offer higher paying and higher quality positions. The capital-to-labor ratio for an industry indicates how much is invested in equipment and technology for every dollar invested in wages and salaries. Industries with a high capital-to-labor ratio tend to be more technologically advanced, profitable, and offer higher salaried positions.

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Summary Table
Texas Industries Showing Employment Growth and Significant Economic Competitiveness

SIC Code	Industry Title	Above the State Median of Absolute Change in Projected Employment	Above the State Median of Percent Change in Projected Employment	Above the State Median of Average Weekly Wages	Above the State Median of OES 2 Staffing Pattern	Above the State Median of Capital to Labor Ratio
Industries Above the State Median of All Employment Growth and Economic Competitiveness Variables (2 + 3)						
45	Transportation by Air	Y	Y	Y	Y	Y
49	Electric, Gas, and Sanitary Services	Y	Y	Y	Y	Y
Industries Above the State Median of Either Absolute Change or Percent Change in Employment, and Above the State Median of All Economic Competitiveness Variables (1 + 3)						
36	Electronic and Other Electrical Equipment and Components, Ex Computer Equipment	Y		Y	Y	Y
48	Communication	Y		Y	Y	Y
60	Depository Institutions	Y		Y	Y	Y
61	Nondepository Credit Institutions		Y	Y	Y	Y
67	Holding and Other Investment Offices		Y	Y	Y	Y
Industries Above the State Median of Each Employment Growth Variables and Above the State Median of Two Economic Competitiveness Variables (2 + 2)						
64	Insurance Agents, Brokers, and Services	Y	Y	Y	Y	
81	Legal Services	Y	Y	Y	Y	
87	Engineering, Accounting, Research, Management, and Related Services	Y	Y	Y	Y	
Industries Above the State Median of Either Absolute Change or Percent Change in Employment, and Above the State Median of Two Economic Competitiveness Variables (1 + 2)						
44	Water Transportation		Y	Y		Y
50	Wholesale Trade, Durable Goods	Y		Y	Y	
89	Misc Services		Y	Y	Y	

Selecting one industry over another does not mean there is no employment demand or high quality employment in the other industry. It simply means that the selected industries offer relatively greater potential for job openings and job quality.[16] For instance, several Retail Trade and Services industries, including Health Services, are not included in the preceding Summary Table because they show strong employment growth but relatively weak economic competitiveness (or poor job quality). While there may be many job openings in these industries, these jobs may not demand highly technical skills or pay high wages. (Health Services, while employing many highly paid and skilled workers, also employs a large number of relatively low paid and low skilled workers like home health aides.) Conversely, most of the Manufacturing industries are not included in the Summary Table because they show strong economic competitiveness but relatively slow or declining employment growth. Particularly in the case of economically competitive industries, it is important to remember that high demand, high skill, and high wage occupations in these industries do exist. These jobs will be harder to come by but will be good jobs. *Remember, too, that distinct occupations within an industry can be exceptions to statewide industry averages.*

Case in Point: Job Movement in the Health Services Industry

A flurry of job-changing activity in a sector of the economy is all too often misinterpreted as a signal of employment growth. Although job changing activity may leave an intuitive impression that growth is occurring, we must guard against elevating untested assumptions and impressions to a status of unquestioned conventional wisdom. In forecasting employment growth we must differentiate new job openings from the circulation of incumbent workers from one employer to another or from one subsector of the economy to another.

The difference between intuitive impressions or conventional wisdom and hard evidence of employment growth is seen clearly in the case of the Health Services industry. New rules in third-party (insurance and government) medical payment plans, for example, have allowed changes in the settings in which health care is delivered. Patients and their families are given more latitude to seek preventive health care in their physicians' offices or to receive services at home or through out-patient clinics. Consequently, there has been employment growth in these health service settings. To understand the total employment picture, however, we must note that these same services were once performed in hospitals. While third-party payment guidelines are creating employment demand growth outside hospitals, they are decreasing employment demand within hospitals. Professionals leaving the hospital employment setting are simply absorbed by other health care settings with little or no change in total occupational employment.

A large portion of activity going on in the national labor market is analogous to the situation found in the Health Services industry. For a number of reasons, more companies are simultaneously downsizing and paying to have the work they need done performed by independent contractors, workers leased through temporary employment agencies, or on an outsource basis. Consequently, the U.S. economy has seen tremendous growth in SIC 73 Business Services, especially SIC 7363 Help Supply (Temporary) Services. Growth in SIC 73 Business Services, therefore, does not necessarily signal a net increase in occupational employment growth because it is offset by industry downsizing and outsourcing.

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[16] Texas State Occupational Information Coordinating Committee, The Texas Economy: An Ever Changing Landscape Affects Us All! (Austin: Texas SOICC, June, 1994).

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This kind of movement usually has no impact directly on occupational duties and tasks, although a change in the location of employment or change of status from permanent employee to temporary worker or independent contractor may have significant lifestyle implications. This suggests that while an occupationally-specific training curriculum may not have to change its skills content, all education and training programs may need to be infused with entrepreneurial components to prepare students to take individual responsibility for their own continued employment security and economic self-sufficiency.

Broad Trends Drive Industry Change and Innovation

What commonalities do these thirteen key industries share? Why do they as a group represent the highest levels of predicted employment growth and job quality? Two broad areas have been identified as explanatory factors for the most significant industry and occupational change occurring in our economy: technological innovation and consumer demand. Each of these factors or trends is interrelated and provides a useful context for understanding changes occurring in the economy as a whole, as well as within specific industries or industry groups. The rest of this chapter discusses these two broad trends; the following chapters focus on trends and innovations specific to the thirteen targeted industries.

Technology. Technology is probably the most significant driver of workplace change. The United States has one of the world's most competitive economies, primarily because of its technological strength. Technological leadership is considered by many as America's greatest differentiator. The largest area of growth in the years ahead, particularly for personal computers (PCs), is predicted to be the home market both here in the Unites States and overseas. The boom in home markets for PCs will boost growth in peripheral sales such as printers, CD-ROMs, modems, and fax machines.[17] A second key technology trend is networking. Stand alone PCs are being connected to form local area networks (LANs) which share peripherals, software, and information. In turn, these LANs are being connected to other LANs to form wide area networks (WANs) that span offices, regions, and countries. The Internet is an example of a WAN. Corporations are recognizing the benefits of these seamless networks, particularly their ability to exchange information.[18]

Information technologies already have begun to revolutionize the way we do business. The big four information technologies include computer networks, imaging technology, massive data storage, and artificial intelligence. These technologies will reshape today's workplace:

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[17] Jim DeTar, "1995's Semiconductor Forecasts May Vary But They Carry Same Tune," Electronic News (January 2, 1995).

[18] Standard and Poor's, Industry Surveys, (New York, 1996).

- Networks will become indispensable for sharing and communicating information. National "information highways" are in the early stages, but growing exponentially. The linkage of these highways will create a global village and marketplace, making it possible to communicate with nearly anyone, anywhere, anytime.
- Imaging technology will make information more user-friendly and will enable the rapid transmission of images.
- Massive data storage systems will handle the expansion of information which will be stored electronically in readily accessible, attractive, and concise formats.
- Artificial-intelligence systems, including expert systems and "knowbots," will become partners with workers, although sometimes they will replace workers.[19]

There is a growing requirement by large companies for their subcontractors to be able to transfer data, graphics, and other information electronically. This will place additional demands on the computing infrastructures and capital investments of smaller firms. Computer and communications professionals are likely to continue to be in high demand for the more sophisticated networks and as interactive communication grows. The development of electronic trading and the demand for attractive customer interfaces in multimedia applications suggests that the demand for graphic artists with strong communication technology skills will be substantial. The growth of interconnected, wide area networks and the explosion of electronic magazines offer greatly enhanced opportunities for network publishing.[20] Nominations collected this year for candidate emerging and evolving occupations in the data/information area include:

Data Communications Technician;
Data Encryption Specialist;
Database Administrator;
Imaging Technician;
Massive Data Storage Technician;
Real-Time Document Sharing Technician; and
Wireless Data Transmission Technician.

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[19] Andy Hines, "Significant Technologies, Futurist (January-February 1994).

[20] Australian National Board of Employment, Education, and Training--Employment and Skills Formation Council, Converging Communications and Computer Technologies: Implications for Australia's Future Employment and Skills (Australia: Australian National Board of Employment, Education, and Training, February 28, 1995).

Nominations collected this year for candidate emerging and evolving occupations in the computer fields include:

Applications/Software Installer;
Computer Installer;
Computer Network/LAN/WAN Administrator;
Computer Programmer;
Computer Security Technician;
Electronic Mail Technician;
Internet Services Technician;
Systems Support Technician; and
Webmaster.

While most emerging and significantly evolving occupations are a function of technological change and consumer demand, we have evidence of another driving force--changes in the law. For example, high technology devices invite new kinds of criminal abuses that cannot be detected by conventional investigative techniques, including computer fraud, theft of intellectual property, breeches of data privacy, and sabotage. The emerging field of Computer Security deals with these very issues.

Consumers. The second major driver of workplace change is consumer demand for goods and services. Consumers are changing and their tastes for goods and services are changing. They want more productive and efficient goods and services for less money. Consumers are demanding mobility, convenience, and flexibility both in the workplace and at home. The market effort to respond to these consumer demands is reflected in the rate of technological change and the production of such goods and services as cellular phones, ATM machines, home banking, airborne data transmission, electronic claims processing, and the speedier delivery of shipped durables. Consumers also are demanding higher quality and more advanced entertainment products such as high-density television and interactive multimedia. Still other consumers demand more environmentally responsible manufacturing and production processes from the companies they choose to support with their dollars.[21]

Demographic and social trends are closely related to consumer trends. The Baby Boomers are aging, growing wealthier, and seeking more comfortable lifestyles. This group exhibits upward trends in purchasing comfortable clothes and a multitude of home entertainment and convenience products. Married couples and homeowners are also on the rise, which means more spending on household durables. The Generation X group is technologically-oriented and, though incomes are more limited, are a significant market for computers, video games, VCRs, and audio equipment.[22]

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[21] Standard and Poor's, Industry Surveys, (New York, 1996).

A significant social trend for many demographic groups has been "cocooning." This phenomenon, as the name suggests, means that more people and families are staying home and demanding products and services that will support this lifestyle. Spending much more time at home has meant that having a pleasing and comfortable environment is becoming increasingly important.[23] Consumption of traditional services to the home--cleaning, gardening, and home delivery--are increasing. In addition, there is a range of new and evolving services which have the potential to grow rapidly with suitable communications infrastructure support. These include transactional services like home shopping and banking, document and news retrieval, on-line reservation systems, and a host of other entertainment and information services. Changing business practices and an emphasis on customer service have also spawned the proliferation of customer service representatives, customer support staff, help desk workers, etc. Individuals in these positions provide assistance to customers by answering phone lines, providing product information, handling inquiries, and taking orders.[24] Nominations collected this year for candidate emerging and evolving occupations in the customer support area include:

Customer Service Representative;
Customer Support Staff;
Information Services Clerk; and
Information Specialist.

Those with a more technological background may provide computer software and/or hardware support. Nominations collected this year for candidate emerging and evolving occupations in the computer support area include:

Computer Help-Desk Worker;
Hardware/Software Technical Support; and
Microcomputer User Support Specialist.

Thirteen Targeted Industries

The thirteen targeted industries for this project are grouped into seven chapters: Chapter Four is Electronics and Semiconductors; Chapter Five is Financial Services; Chapter Six is Professional

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[22] Standard and Poor's, Industry Surveys, (New York, 1996).

[23] Standard and Poor's, Industry Surveys, (New York, 1996).

[24] Australian National Board of Employment, Education, and Training--Employment and Skills Formation Council, Converging Communications and Computer Technologies: Implications for Australia's Future Employment and Skills (Australia: Australian National Board of Employment, Education, and Training, February 28, 1995).

Services; Chapter Seven is Telecommunications; Chapter Eight is Transportation; Chapter Nine is Energy and Utilities; and Chapter Ten is Wholesale Trade. Each chapter examines in detail the major subsectors composing each industry and lists the nominated candidates for emerging and evolving occupations in that industry or industry grouping. The following is a summary table of both cross-industry and industry-specific candidate titles for emerging and evolving occupations. These occupational titles were compiled from nominations submitted by workforce development professionals, education and training professionals, employers and industry experts, and from other career guidance resources.[25] These are the most significant emerging and evolving titles in these industries. This list is not exhaustive, but rather is a guide to the most promising non-baccalaureate career choices for students and adult job-seekers.

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[25] The following health care occupational titles, while falling outside our targeted industries, were nominated by field professionals and may suggest employment demand in these areas: Intergenerational Caregiver; Certified Home Health Aide; Medical Records Technician/Medical Coder; Medical Support Personnel; Certified Medication Aide; Diagnostic Imaging Specialist; Donor Procurement Technician; MRI Technician; Nuclear Medicine Technician; Cardiopulmonary Technician; Bronchogenic Screen Technician; Computer Tomograph Technician; Prosthetic/Orthotic Technician; Addictions Technician; Autopsy Technician; and Biomedical Equipment Technician.

INDUSTRY	ASSOCIATED OCCUPATIONS/ OCCUPATIONAL CLUSTERS
Emerging and Evolving Occupations spanning all thirteen targeted industries	**Computer Networking Technician** Also listed as: Applications/Software Installer Computer Installer Computer Network/LAN/WAN Administrator Computer Security Technician Electronic Mail Technician Internet Services Technician Systems Support Technician Webmaster **Computer Programmer** Also listed as: Computer Programmer (4th Generation) Object-Oriented Computer Programmer (3rd Generation) **Computer Support Technician** Also listed as: Computer Help-Desk Worker Hardware/Software Technical Support Microcomputer User Support Specialist **Customer Support Specialist** Also listed as: Customer Service Representative Customer Support Staff Information Services Clerk Information Specialist **Data/Information Specialist** Also listed as: Data Communications Technician Data Encryption Specialist Database Administrator Imaging Technician Massive Data Storage Technician Real-Time Document Sharing Technician Wireless Data Transmission Technician

INDUSTRY	ASSOCIATED OCCUPATIONS/ OCCUPATIONAL CLUSTERS
SIC 36--Electronics, Electrical Equipment, and Semiconductors	**Semiconductor Technician/Operator** Also listed as: Chemical Vapor Deposition Technician Diffusion/Doping Technician Dry Etch Technician Ion Implant Technician Laser Technician Oxidation Technician Packing Technician Photolithography/Microlithography Technician Photonics Technician/Electro-Optical Technician Process Technician Thin Films Technician Wafer Preparation Technician Wet Etch Technician **Other Industry Occupational Areas:** Automation/Robotics Technician Circuit Card Tester High-Density Energy Battery Technician High-Density Television (HDTV) Technician Manufacturing Technician/Production Technician Microwave Technician Miniaturization Technician
SICs 60, 61, 67, and 64--Financial Services + Insurance	**Banking**: Automatic Teller Machine Servicer/Clerk Global Representative **Insurance**: Compliance Officer/Utilization Review Coordinator Insurance Claims Clerk Medical Eligibles Specialist Provider Relations Representative Reimbursement Specialist
SICs 87, 81, and 89--Professional Services	**Industry Occupational Areas:** Data Acquisition and Verification Technician Electronic Research Technician Litigation Support Specialist Meeting/Event Planner Phone Poller/Interviewer

INDUSTRY	ASSOCIATED OCCUPATIONS/ OCCUPATIONAL CLUSTERS
SIC 48--Telecommunications	**Multimedia Specialist** Also listed as: Computer Graphics Technician Desk Top Publishing Specialist/Operator Multimedia Software Designer Multimedia Specialist Plug and Play Internet Application Developer Print and Graphics Imaging Technician **Wireless Communications Technician** Also listed as: Cellular Phone Installer Cellular Technician Personal Communications Services Specialist Radio Communications Technician Wireless Data Transmissions Technician **Other Industry Occupational Areas:** Carrier Frame Relay Services Specialist Direct Broadcast Service Satellite Technician Fiber Optics Technician Videoserver Technician
SICs 45 and 44--Transportation (Air and Water) **and SIC 50--Wholesale Trade**	**Navigation/Mapping/Surveying Specialist** Also listed as: Geographic Information System (GIS) Specialist GIS Cadastralist Global Positioning System Technician **Other Industry Occupational Area:** Inventory/Warehousing/Logistics Specialist **Air Transport Technician** Aviation Mechanic Avionics Technician Noise Abatement Technician

INDUSTRY	ASSOCIATED OCCUPATIONS/ OCCUPATIONAL CLUSTERS
SIC 49--Utilities (Electricity, Gas, and Sanitation)	**Industry Occupational Areas:** Air Monitoring/Emissions Technician Alternative Fuels Technician/Hybrid Fuel Technician Chemical Safety Technician Decontamination Technician Environmental Quality Specialist Hazardous Materials Removal Worker Home Energy Efficiency Auditor Reclamation/Reuse Technician Utilities Plant Technician/Operator Water Quality Specialist **Major Occupational Clusters:** Energy Conservation Recycling and Restoration Remediation of Environmental Contamination Renewable Energies Solid and Hazardous Waste Management

CHAPTER FOUR:
ELECTRONIC COMPONENTS AND EQUIPMENT AND SUPERCONDUCTORS

Chapter In Focus

Demand for electronic components comes primarily from the computer, telecommunications, instrumentation, medical equipment, and transportation industries. The semiconductor sector of the electronics industry is the basic technical foundation for growth in many of these industries. Within the next few years, new consumer products such as high-density television, interactive multimedia, and hand-held computers will enter the U.S. market. These products will be based on developing technologies, including multichip modules, voice recognition, voice synthesis, image processing, character recognition, and artificial intelligence. All of these products will require increasing quantities of electronic components, both sophisticated semiconductors and advanced components. Many will use digital technologies.

Occupations nominated as emerging or evolving within the Electronics, Electrical Equipment, and Semiconductors industry include:

Semiconductor Technician/Operator

Alternative or related titles include: Chemical Vapor Deposition Technician, Diffusion/Doping Technician, Dry Etch Technician, Ion Implant Technician, Laser Technician, Oxidation Technician, Packing Technician, Photolithography/Microlithography Technician, Photonics Technician/Electro-Optical Technician, Process Technician, Thin Films Technician, Wafer Preparation Technician, and Wet Etch Technician.

Other industry-related occupational areas include:

Automation/Robotics Technician
Circuit Card Tester
High-Density Energy Battery Technician
High-Density Television Technician
Manufacturing Technician/Production Technician
Microwave Technician
Miniaturization Technician

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Chapter in Detail

Electronic and other Electrical Equipment and Components, except Computer Equipment (SIC 36) includes establishments engaged in manufacturing machinery, apparatus, and supplies for the generation, storage, transmission, transformation, and utilization of electrical energy. Included are the manufacturing of electricity distribution equipment, electrical industrial apparatus, household appliances, electrical lighting and wiring equipment, radio and television receiving equipment, communications equipment, electronic components and accessories, and other electrical equipment and supplies.[26] *(Note that Telecommunications Equipment industry subsectors [SIC 3661 and 3663] are discussed in the Telecommunications Services section; Electrical Equipment and Renewable Energy Equipment industry subsectors [SIC 3612, 3613, and 3625] are discussed in the Utilities section.)*

Electronic Components. Electronic components are the fundamental building blocks for the electronics industry. A wide variety of products comprise this category, including electron tubes, printed circuit boards, semiconductors and diodes, capacitors, resistors, coils and transformers, and connectors. Today's customers demand higher performance, more functionality, and continued miniaturization of physical characteristics at ultra-competitive prices. Demand for electronic components comes primarily from the computer, telecommunications, instrumentation, medical equipment, and transportation industries. Worldwide competition in the electronics components industry is fierce. The United States faces continued strong competition from Japan and other countries in technologically sophisticated products.

Shipments of electronic components are forecast to grow at an annual rate of 6 to 8 percent through the late 1990's. Components suppliers will face continuing demand for higher performance products. The increased complexity of the packaging and the interconnection of high-performance systems places a premium on compatibility among components. The transition to surface-mounted, or chip, devices and toward passive network products, such as resistor networks, will continue through the year 2000. Within the next few years, new consumer products such as high-density television, interactive multimedia, and hand-held computers will enter the U.S. household market. These products will be based on developing technologies, including multichip modules, voice recognition, voice synthesis, image processing, character recognition, and artificial intelligence. All of these products will require increasing quantities of electronic components, both sophisticated semiconductors and advanced components. Many will use digital technologies.[27]

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[26] Industry categories under SIC 36 include SIC 3612-Power, Distribution, and Specialty Transformers; SIC 3613-Switchgear and Switchboard Apparatus; SIC 3621-Motors and Generators; SIC 3624-Carbon and Graphite Products; SIC 3625-Relays and Industrial Controls; SIC 3629-Electrical Industrial Apparatus, Not Elsewhere Classified; SIC 3631-Household Cooking Equipment; SIC 3632-Household Refrigerators and Home and Farm Freezers; SIC 3633-Household Laundry Equipment; SIC 3634-Electric Housewares and Fans; SIC 3635-Household Vacuum Cleaners; SIC 3639-Household Appliances, Not Elsewhere Classified; SIC 3641-Electric Lam Bulbs and Tubes; SIC 3643-Current-Carrying Wiring Devices; SIC 3644-Noncurrent-Carrying Wiring Devices; SIC 3645-Residential Electric Lighting Fixtures; SIC 3646-Commercial, Industrial, and Institutional Electric Lighting Fixtures; SIC 3647-Vehicular Lighting Equipment; SIC 3648-Lighting Equipment, Not Elsewhere Classified; SIC 3651-Household Audio and Video Equipment; SIC 3652-Phonograph Records and Prerecorded Audio Tapes and Disks; SIC 3661-Telephone and Telegraph Apparatus; SIC 3663-Radio and Television Broadcasting and Communications Equipment; SIC 3669-Communications Equipment, Not Elsewhere Classified; SIC 3671-Electron Tubes; SIC 3672-Printed Circuit Boards; SIC 3674-Semiconductors and Related Devices; SIC 3675-Electronic Capacitors; SIC 3676-Electronic Resistors; SIC 3677-Electronic Coils, Transformers, and Other Inductors; SIC 3678-Electronic Connectors; SIC 3679-Electronic Components, Not Elsewhere Classified; SIC 3691-Storage Batteries; SIC 3692-Primaries Batteries, Dry and Wet; SIC 3694-Electrical Equipment for Internal Combustion Engines; SIC 3695-Magnetic and Optical Recording Media; and SIC 3699-Electrical Machinery, Equipment, and Supplies, Not Elsewhere Classified.

Semiconductors and Related Devices. The U.S. semiconductor industry continued its recovery in 1993 because of renewed growth in major markets worldwide. U.S. companies experienced increased sales in every regional market, with the strongest growth occurring in North America and the Pacific Basin. Integrated circuits accounted for nearly 85% of all worldwide semiconductor sales in 1993 followed by single-function (discrete) semiconductors and optoelectronic semiconductors.[28]

The microcomponent integrated circuit category includes microprocessors, microcontrollers, microperipherals, and digital signal processors. In addition to rising demand for semiconductors, increasing sales of personal computers and PC peripherals[29] also have driven demand for microcomponents. The greatest excitement in the microcomponent field has been generated by microprocessors. Microprocessor designs increasingly incorporate circuitry for other system elements onto a single chip. Advances in microprocessor technology have led to the development of products ranging from fax machines and cellular phones to camcorders and hand-held computers--products that would have been impossible to manufacture in the past.[30]

Other active electronic components include discrete semiconductors and electron tubes. Discrete semiconductors have a single electrical functional component, such as a diode, transistor, or thyristor. These devices, unlike integrated circuits, must be combined with other components to provide a basic electrical function, such as amplification or switching. Some transistors are moving away from metal towards plastic, allowing greater flexibility in product design. For instance, transistors printed on a sheet of plastic would allow a portable computer notebook screen to roll up like a sheet of paper. Flexible plastic transistors may change the shape of future computing.[31]

Electron tubes comprise cathode ray tubes (e.g. TV picture tubes) and a large variety of power and special purpose tubes. Cathode ray tubes also are used in computer monitors, oscilloscope displays, and other testing and measuring devices. Due to their close relationship with the television industry, the market for cathode ray tubes will parallel strong growth in the production of consumer electronics. The future development of multimedia entertainment systems and high-density television will drive the market for cathode ray tubes.[32]

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[27] U.S. Department of Commerce, U.S. Industrial Outlook 1994: Forecasts for Selected Manufacturing and Service Industries (Washington, D.C., January 1994).

[28] U.S. Department of Commerce, U.S. Industrial Outlook 1994: Forecasts for Selected Manufacturing and Service Industries (Washington, D.C., January 1994).

[29] Jim DeTar, "1995's Semiconductor Forecasts May Vary but They Carry Same Tune," Electronic News (January 2, 1995).

[30] Standard and Poor's, Industry Surveys, (New York, 1996).

[31] Alfred Poor, "Roll Up Your Screen!" PC Magazine (December 6, 1994).

Semiconductors and Related Devices--Long Term Outlook. The semiconductor industry is experiencing phenomenal growth, mainly due to the computer and telecommunications boom.[33] One economist considers semiconductors to be today's most vital products since they form the basic technical foundation for many other industries.[34] Product innovation in the design and fabrication of integrated circuits has focused on the reduction of minimum feature size and the efficiency with which greater numbers of circuits can be packed onto a chip..[35]

Electronic products contain an every increasing number of semiconductors.[36] Growing end use markets for semiconductors include pen-based computers, high-density digital television (HDTV), personal computers, multimedia integrated services digital networks (ISDNs), portable cellular phones, "smart" credit cards, and other communications products.[37] Although the automotive market is not expected to grow dramatically, the value of automobile electronic devices will continue to expand. Semiconductor sales to auto parts companies are expected to grow, especially those used in safety features such as airbags, collision detection, security equipment, on-board navigational guides, and anti-lock brakes.[38] In addition, semiconductors are used in cars for engine management, audio systems, and automatic speedometers.[39]

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[32] U.S. Department of Commerce, U.S. Industrial Outlook 1994: Forecasts for Selected Manufacturing and Service Industries (Washington, D.C., January 1994).

[33] Jodi Dorman, "Targeting 1995's Fastest Growing Industries," Best's Review-Property and Casualty (June 1995) and Standard and Poor's, Industry Surveys, (New York, 1996).

[34] Nuala Beck, Shifting Gears: Thriving in the New Economy, (New York: Harper Collins, 1995.)

[35] U.S. Department of Commerce, U.S. Industrial Outlook 1994: Forecasts for Selected Manufacturing and Service Industries (Washington, D.C., January 1994).

[36] Standard and Poor's, Industry Surveys, (New York, 1996).

[37] Jodi Dorman, "Targeting 1995's Fastest Growing Industries," Best's Review-Property and Casualty (June 1995).

[38] U.S. Department of Commerce, U.S. Industrial Outlook 1994: Forecasts for Selected Manufacturing and Service Industries (Washington, D.C., January 1994).

[39] Standard and Poor's, Industry Surveys, (New York, 1996).

ISDN is hailed as one of the technologies crucial to the evolution of the information superhighway. It involves digital mixtures of text, audio, video, and graphics for multimedia transmission. Retail, medicine, travel, banking, and security are a few of the industry sectors already using ISDN to transform their businesses. This digital transmission system allows quick transfer of data, electronic fund transfers, electronic surveillance, etc. The fashion and home furnishings retailer, Laura Ashley, uses ISDN to speed credit card validation and to monitor trading. Travel agents use live interactive on-line information and video capability to allow customers to view dream vacation sites.[40]

The arrival of HDTV in the United States, estimated to occur in 1997, will provide another strong market for semiconductors. HDTV doubles the number of scan lines, yielding a picture that is four to five times as clear as the image on today's television sets. In conjunction with high quality digital sound, this technology is expected to create enormous consumer spending for new television sets. High-density digital television sets will be bigger and display clearer pictures than today's television sets. HDTV also will have other applications ranging from medical imaging to computer graphics.[41]

The "smart" credit card is yet another potential strong market for semiconductors. Although smart cards will look just like regular credit cards, microprocessor chips embedded in the corner of the card will provide numerous conveniences, including greater security and flexibility. These cards could be used as a security tool to provide an authorized user access to cash and credit facilities, buildings, computer systems, health records, pay television, and telephone booths. Moreover, the microprocessor chip could curb current forms of credit card fraud.[42]

Printed Circuit Boards. The printed circuit board (PCB) provides both the physical structure for mounting components and the electrical interconnection between the components. When electronic components are mounted on a PCB, the combination is an electronic assembly. This assembly is the primary building block for electronic systems, such as those in the computer, consumer electronics, telecommunications, automotive, industrial, and military sectors. Interconnections have grown in importance with the electronics industry's strong emphasis on miniaturization in the packaging of electronic components that go into electronic systems. Interconnection considerations create an interdependent relationship among printed circuit material and equipment suppliers, printed circuit board vendors, and electronic systems customers. Thus, the maintenance of a strong PCB and interconnection industry is fundamental to the competitiveness of the rest of the electronics "food chain."[43]

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[40] Julia King, "ISDN Key Role in Multimedia," Financial Times (October 3, 1996).

[41] Standard and Poor's, Industry Surveys, (New York, 1996) and Laurent Belsie, "Digital TV Era: Shopping, Video Calls from Grandma," The Christian Science Monitor (January 17, 1995).

[42] Standard and Poor's, Industry Surveys, (New York, 1996).

Semiconductor Manufacturing Equipment. The semiconductor manufacturing equipment (SME) industry makes the equipment used in producing semiconductors, both integrated circuits and discrete devices. The industry can be divided into four categories: wafer processing equipment, testing, material handling and process diagnostics equipment, and assembly equipment. Personal computer sales and programs operating in Windows environments requiring more memory are creating a high demand for semiconductors which in turn help fuel the demand for SME.[44]

Wafer processing equipment, used in front-end fabrication, includes the equipment for deposition and diffusion, lithography, ion implantation, and etching and cleaning. Front-end equipment accounts for more than 50% of SME sales. Spending on deposition and related equipment has been the largest front-end equipment sector. Deposition equipment is used to deposit or develop materials on wafer surfaces. These layers form the wires and insulators that interconnect the transistors of the device. The most significant factor in predicted growth is the shift to multilevel interconnect processes, which continue to proliferate as device geometries shrink and chip integration levels escalate.[45]

Equipment for testing, material handling, and process diagnostics comprise about 30% of SME sales. Higher pincounts and the spread of surface mount technology has necessitated new test and assembly equipment. Sales of this equipment is expected to grow, particularly automatic test equipment (ATE). More complex semiconductors will require more complex ATEs.[46] The U.S. is particularly strong in laser repair equipment, which should experience future growth because of its use in the production of advanced semiconductors and flat-panel displays. In the process diagnostics market, the U.S. has particular strength in instruments that measure film thickness, wafer flatness, and defect inspection tools. Process diagnostics are well adapted to the flat-panel display industry. Technological developments in flat-panel displays (the most common type being liquid crystal displays), multi-chip modules, and next-generation semiconductors and computers will steadily increase the demand for top-of-the-line capital equipment.[47]

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[43] U.S. Department of Commerce, U.S. Industrial Outlook 1994: Forecasts for Selected Manufacturing and Service Industries (Washington, D.C., January 1994).

[44] U.S. Department of Commerce, U.S. Industrial Outlook 1994: Forecasts for Selected Manufacturing and Service Industries (Washington, D.C., January 1994).

[45] U.S. Department of Commerce, U.S. Industrial Outlook 1994: Forecasts for Selected Manufacturing and Service Industries (Washington, D.C., January 1994) and Standard and Poor's, Industry Surveys, (New York, 1996).

[46] Standard and Poor's, Industry Surveys, (New York, 1996).

Superconductive Devices. Superconductivity, a phenomena that occurs in certain metals or alloys, ceramics, and carbon-cluster compounds, is characterized by a vanishing electrical resistance at specific temperatures and the expulsion of magnetic fields. In microelectronics, the ultimate performance levels of superconductors--high speed, high sensitivity, a high degree of accuracy, low power consumption, and low heat dispersion--are unmatched by any devices based on other materials. Superconductors are considered one of the critical future technologies in defense and commercial applications. Predictions about future developments are difficult in a rapidly emerging technology. If progress and funding continue, researchers predict significant progress in the next few years in both low-temperature and high-temperature superconductors.[48] It appears that the major commercial markets for superconductors may include medicine and science, where superconducting magnets are extensively used in magnetic resonance imaging (MRI) and spectroscopy. By the next century, applications in electronics, energy, and other areas outside of the medical and scientific fields are projected to increase to 70% of the estimated $8 to $12 billion superconductor market. Within the next 30 years, electronic applications are projected to increase steadily.[49]

Passive Components. Passive components cover a wide range of products. The major categories are capacitors, resistors, coils, transformers, connectors, switches, relays, and piezoelectric devices. In electronic applications, capacitors are used for filtering, tuning, coupling, isolating, and storing electrical energy. The primary end markets of capacitors are consumer electronics and automotive and computer equipment. Trends in the capacitor industry are toward surface mounting and the miniaturization of multilayer capacitor chips. Capacitors were one of the first components to become available as surface-mount or chip components and have led the miniaturization drive in passive components. The transition from surface-mounted, or chip, devices toward passive network products, such as resistor networks, will continue through the year 2000. U.S. passive component suppliers face strong competition in world markets and will be challenged to employ high-volume, low-cost manufacturing strategies. The growth of connector markets worldwide will continue to parallel sales volumes in the end products, with primary demand coming from computers and telecommunications.[50]

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[47] U.S. Department of Commerce, U.S. Industrial Outlook 1994: Forecasts for Selected Manufacturing and Service Industries (Washington, D.C., January 1994).

[48] Bruce Nordwall, "Upgrades and Civil Avionics to Counter Budget Squeezes," Aviation Week and Space Technology (March 20, 1989). •It is important to note that government funding has indeed been reduced in this area and research efforts such as the Waxahachie, Texas-based Superconducting Supercollider have taken major funding hits since the publication of this article.

[49] U.S. Department of Commerce, U.S. Industrial Outlook 1994: Forecasts for Selected Manufacturing and Service Industries (Washington, D.C., January 1994).

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[50] U.S. Department of Commerce, U.S. Industrial Outlook 1994: Forecasts for Selected Manufacturing and Service Industries (Washington, D.C., January 1994).

CHAPTER FIVE: FINANCIAL SERVICES

Chapter in Focus

As increasingly global and technologically sophisticated banking, investment, and insurance markets evolve, there will be more electronic linkages and more automation of all sectors of the financial services industries. Most customers will see greater access through on-line systems and telephones. With such access, banking could develop into a comprehensive information package that would include such non-bank activities as insurance, entertainment, and travel as well as business and sports news. With the integration of bank services, investment services, and insurance services, banks and insurance companies will form partnerships to provide more complete and seamless services to customers.

Occupations nominated as emerging or evolving within the Banking sector of the Financial Services industries include:

Automatic Teller Machine Servicer/Clerk
Global Representative

Occupations nominated as emerging or evolving within the Insurance sector of the Financial Services industries include:

Compliance Officer/Utilization Review Coordinator
Insurance Claims Clerk
Medical Eligibles Specialist
Provider Relations Representative
Reimbursement Specialist

Chapter in Detail

This chapter includes a discussion of depository institutions, nondepository institutions, holding and investment companies, and insurance agents and brokers. These are all considered aspects of the financial services and investment industry.

Depository Institutions

Depository Institutions (SIC 60) includes institutions engaged in deposit banking or closely related functions, including fiduciary activities.[51] Banks and savings institutions are expected to continue their evolution into a structure featuring a regional bank holding company that operates independent depository, commercial and consumer lending, mortgage lending and mortgage servicing, insurance, and securities units. Banks expect securities activities to become a significant growth area. Community development banking also has increased in prominence.[52]

Commercial Banking. The future of banking and all financial services rests on information technology rather than branch locations of brick and mortar. The competitive edge will lie with banks' ability to provide convenience and flexibility to customers.[53] Customer use of automated teller machines (ATMs) has been rising significantly over the past few years with the result that branch operating costs have been falling. Soon, ATMs will provide customers with not only the traditional services of fund withdrawal, deposit, and transfer, they also will allow them to pay bills and access investment accounts to gain information on and to purchase mutual funds, certificates of deposit, and individual retirement accounts. The revolution in personal computer technology is the real driving force behind the increasing sophistication of ATMs. The possibilities for ATM software applications are seemingly endless.[54] Some ATM software developers have experimented with programs which allow ATMs to dispense stamps, bus tickets, and coupons.[55]

Other alternative service delivery mechanisms, such as in-store mini-branches, multimedia kiosks, and telephone banking centers, are changing the face of banking. These alternative delivery mechanisms have been dubbed "lifestyle banking"--customers can choose whichever method they prefer. Despite the increasing availability of electronic services, some customers still will prefer to conduct their transactions with a human being. This being the case, customer service and sales ability are still critical skills for this industry.[56]

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[51] Check the SIC Manual for more detail. Industry categories under SIC 60 include SIC 6011-Federal Reserve Banks; SIC 6019-Central Reserve Depository Institutions, Not Elsewhere Classified; SIC 6021-National Commercial Banks; SIC 6022-State Commercial Banks; SIC 6029-Commercial Banks, Not Elsewhere Classified; SIC 6035-Savings Institutions, Federally Chartered; SIC 6036-Savings Institutions, Not Federal Chartered; SIC 6061-Credit Unions, Federally Chartered; SIC 6062-Credit Unions, Not Federally Chartered; SIC 6081-Branches and Agencies of Foreign Banks; and SIC 6082-Foreign Trade and International Banking Institutions.

[52] U.S. Department of Commerce, U.S. Industrial Outlook 1994: Forecasts for Selected Manufacturing and Service Industries (Washington, D.C., January 1994).

[53] Lauren Gibbons Paul, "Banking on the Future," PC Week (January 29, 1996) and Standard and Poor's, Industry Surveys, (New York, 1996).

[54] "A New Image," United States Banker (July 1991).

[55] Hope Hamashige, "Banks, Brokerages Debut Host of High Tech Services," Los Angeles Business Journal (March 14, 1994).

In the home banking field, it seems that the problems that existed in the 1980s still prevail in the 1990s. It is a relatively expensive service that requires a personal computer, a modem, and the necessary software. However, for the sophisticated customer, it facilitates paying bills, transferring funds, and opening new accounts. As the equipment becomes less expensive and as banks offer a broader array of services, home banking could develop into a comprehensive information package that would include such non-bank activities as insurance, entertainment, and travel as well as business and sports news.[57]

Commercial Banking--Long Term Outlook. During the late 1990s, legislators and regulators alike will feel increasing pressure to address many of the problems affecting the commercial banking industry. Most important among these issues will be the need to expand the opportunities for risk diversification for banks by removing the boundaries separating the banking, securities, and insurance businesses.[58]

While computerization of financial services speeds on, the financial industry must make sure it can provide data privacy and security for themselves and their customers. Financial services and other information technologies--in particular credit card companies--are leading this effort and setting the protocols for secure and private transactions over the Internet among consumers and providers.[59] Secure card-payment systems and other data encryption processes carry enormous implications for digital cash commerce on the Internet. The convenience and protection of secure transaction systems is expected to detonate an Internet explosion.[60] Moreover, secure transaction systems will enable a whole array of financial activities and services to take place on public networks. Eventually, the

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[56] Lauren Gibbons Paul, "Banking on the Future," PC Week (January 29, 1996).

[57] U.S. Department of Commerce, U.S. Industrial Outlook 1994: Forecasts for Selected Manufacturing and Service Industries (Washington, D.C., January 1994).

[58] Jodi Dorman, "Targeting 1995's Fastest Growing Industries," Best's Review-Property and Casualty (June 1995) and Standard and Poor's, Industry Surveys, (New York, 1996).

[59] Katherine Burger, "Absent at the Creation--Insurance's Use of the Internet," Insurance and Technology (November 1995). The Internet is a global network of computer networks.

[60] Russel Mitchell, "Safe Passage in Cyberspace" Business Week (March 20, 1995).

Internet is expected to become the public data network of choice. The additional competition brought about by telecommunications deregulation will accelerate the Internet's popularity.[61]

Savings Institutions. The savings industry is currently divided into three segments--private sector savings associations, savings banks, and "hybrid" savings banks. Savings institutions are contracting due to conversions, mergers, and acquisitions. Savings banks, like savings associations, are also contracting as a group. Since mortgages are the backbone of savings institutions, an improved economy would help thrifts by generating increased demand for residential mortgage loans.[62]

Credit Unions. Credit unions are cooperative financial institutions that provide saving and lending services to their members. In addition to basic services, larger credit unions offer transaction accounts (analogous to checking accounts), ATMs, credit cards, individual retirement accounts, and other services. Credit unions in 1993 heightened their focus on community development banking with more than 140 institutions increasing their services to lower income members. In Texas, credit unions are expected to grow by 42% through the year 2000.[63] The credit union system, through its voluntary associational "leagues," also is focusing more attention on helping credit unions that have taken on these special challenges and making sure the lower-income sector of each credit union's field of membership is served.[64]

Holding and Other Investment Offices

Holding and Other Investment Offices (SIC 67) includes investment trusts, investment companies, holding companies, and miscellaneous investment offices.[65] Holding companies are establishments primarily engaged in owning the securities of banks or other companies for the purpose of exercising control. Management investment offices issue shares that require redemption by the company upon request of the security holder, including money market mutual funds. Other investment offices issue unit investment trusts or guaranteed face-amount certificates, as well as shares that do not require redemption by the company upon request of the security holder. Face-amount certificates are essentially obligations of the issuing company to pay a fixed sum at a specified maturity date and,

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[61] Dorothy Denning, "The Case for Clipper," Technology Review (July 1995) and Michael Gianturco, "Digital Cash," Forbes (August 14, 1995) and "VLSI to Embed RSA Encryption Under License," Electronic News (January 16, 1995).

[62] U.S. Department of Commerce, U.S. Industrial Outlook 1994: Forecasts for Selected Manufacturing and Service Industries (Washington, D.C., January 1994).

[63] Texas Employment Commission industry projections data for 1993 to 2000.

[64] U.S. Department of Commerce, U.S. Industrial Outlook 1994: Forecasts for Selected Manufacturing and Service Industries (Washington, D.C., January 1994).

[65] Industry categories under SIC 67 include SIC 6712-Offices of Bank Holding Companies; SIC 6719-Offices of Holding Companies, Not Elsewhere Classified; SIC 6722-Management Investment Offices, Open-End; SIC 6726-Unit Investment Trusts, Face-Amount Certificate Offices, and Closed-End Management Investment Offices; SIC 6732-Educational, Religious, and Charitable Trusts; SIC 6733-Trusts, Except Educational, Religious, and Charitable; SIC 6792-Oil Royalty Traders; SIC 6794-Patent Owners and Lessors; SIC 6798-Real Estate Investment Trusts; and SIC 6799-Investors, Not Elsewhere Classified.

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usually require periodic payments by the purchaser. Examples include Government National Mortgage Association pools, investors' syndicates, and other closed-end investment funds. Still other investment firms manage the funds of individual trusts and foundations, including educational, religious, and charitable trusts.

Holding and Investment Companies--Long Term Outlook. Banks are expected to continue to press against the legal barriers separating commercial and investment banking.[66] Investment companies will continue their efforts to develop new products, new markets, and access new trading technologies.[67] As increasingly global and technologically sophisticated banking and investment markets evolve, there will be more electronic linkages and more automation of all aspects of the banking and investing process. Some industry experts believe that computerization has changed the investment market so radically--especially stock trading--that technology is now one of the most important determinants of how the next stage of the market's evolution will be managed.[68]

Demand for new software in the investment industry is very strong. Much of the current technological effort is devoted to increasing the capacity of the market and to providing the latest information to investors. Most customers will see greater access through on-line systems and telephones, enabling them to trade stock and mutual fund shares via voice-activated computer technologies and get real-time quotes. Back-office operations will also benefit. Brokers' workstations will track customer accounts and performance of mutual funds within seconds.[69] As the industry becomes more fully automated, the broker's traditional specialist/dealer role will evolve into a facilitator role for customers.[70]

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[66] Standard and Poor's, Industry Surveys, (New York, 1996).

[67] U.S. Department of Commerce, U.S. Industrial Outlook 1994: Forecasts for Selected Manufacturing and Service Industries (Washington, D.C., January 1994).

[68] David Wright, "Technology and Performance--the Evolution of Market Mechanisms," Business Horizons (November-December, 1989).

[69] Hope Hamashige, "Banks, Brokerages Debut Host of High Tech Services," Los Angeles Business Journal (March 14, 1994).

[70] David Wright, "Technology and Performance--the Evolution of Market Mechanisms," Business Horizons (November-December, 1989).

Nondepository Institutions

The industry sector of Nondepository Institutions (SIC 61) includes firms engaged in extending credit in the form of loans, but not engaged in deposit banking.[71] This includes cooperative loan associations organized to finance the short-term credit needs of their members. Examples include financing of automobiles, appliances, and mortgage companies. See section on Credit Unions above.

Insurance Agents, Brokers, and Service

Insurance Agents, Brokers, and Service (SIC 64) includes agents and brokers dealing in insurance, and organizations offering services to insurance companies and to policyholders.[72] This industry includes agents primarily representing one or more insurance carriers, or brokers not representing any particular carriers but primarily engaged as independent contractors in the sale or placement of insurance contract with carriers. This industry also includes independent organizations concerned with insurance services, including adjustors, advisory services, educational services, information bureaus, inspectors, loss prevention services, patrol services, claims processing, and research organizations.

Insurance and financial markets are becoming increasingly global. The rise in personal income and savings in many areas around the world, and the need to protect this wealth, provides significant opportunities for insurers. The U.S. has the largest insurance market in the world. The size of the U.S. nonlife insurance market is due mainly to health insurance and casualty insurance. Also, compared to other countries, the tort-liability system in the U.S. leans strongly toward fully indemnifying people harmed as the result of the action or products of others, leading to an increased demand for professional and product liability insurance.[73]

Demographic variables, such as income growth, wealth accumulation, population and workforce changes, and home ownership will determine the demand for insurance products and services over the long term. The rate of personal savings in the United States will rise with the movement of the Baby Boom population into middle age. The aging of the Baby Boomers will raise the demand of individuals for products that provide for retirement income and for health care financing. Health care reform, however, likely will diminish the growth of private health insurance, especially indemnity insurance.[74]

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[71] Industry categories under SIC 61 include SIC 6111-Federal and Federally-Sponsored Credit Agencies; SIC 6141-Personal Credit Institutions; SIC 6153-Short-Term Business Credit Institutions, Except Agricultural; SIC 6159-Miscellaneous Business Credit Institutions; SIC 6163-Mortgage Bankers and Loan Correspondents; and SIC 6153-Loan Brokers.

[72] The detailed industry category included under SIC 64 is SIC 6411-Insurance Agents, Brokers, and Service.

[73] U.S. Department of Commerce, U.S. Industrial Outlook 1994: Forecasts for Selected Manufacturing and Service Industries (Washington, D.C., January 1994).

The integration of financial services industries remains a key issue affecting competition in insurance. Banks may be authorized to sell and underwrite insurance. If this occurs, banks, mutual funds, and other financial institutions will be offering investment and savings products that directly compete with insurance and annuity products. With recent litigation deciding in favor of allowing banks to continue selling annuities--viewing annuities as investment rather than insurance products--banks may step up their efforts to form marketing arrangements with insurance companies.[75]

These conflicting forces and issues will change the nature of the industry, especially as more and more services are automated. To compete, insurance companies, independent agents, and peripheral services will have to specialize in certain markets, reduce operating costs, increase efficiency and service quality, and improve management of their assets and liabilities. Agents will have to increase production by utilizing tools that improve the process of policy issuance and management, like kiosks or call centers.[76] Insurers will be forced to look for cost-efficient alternatives such as direct mail, imaging, and electronic file transfer, as well as other information and communications technologies to increase efficiency in underwriting, distributing, investment, claims, and administrative activities.[77]

One technology many insurers now access is the Internet. Whether they are trying to communicate more effectively with customers and colleagues, or find a more flexible way to deliver products and services, many insurers are pursuing the Internet as a medium for conducting business. The proliferation of insurance home pages will be good for the industry, since the population of Internet users is expected to grow to more than 200 million by the year 2000.[78]

Another communications technology affecting the insurance industry will be client/server computing. Growing numbers of insurers are moving away from a mainframe environment towards the more flexible and responsive client/server environment. Industry experts feel client/server computing is the technology with the most potential to improve competitiveness. This type of computing environment will increase the industry's flexibility to respond to changing business conditions, empower end-users, increase operating efficiency, and enable providers to serve customers better.[79] As one industry expert put it, "In a competitive financial services world, the differentiator is customer service."

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[74] U.S. Department of Commerce, U.S. Industrial Outlook 1994: Forecasts for Selected Manufacturing and Service Industries (Washington, D.C., January 1994).

[75] Elizabeth Daniele, "Banks in Insurance-More Market Driven Change," Insurance and Technology (March 1995) and Standard and Poor's, Industry Surveys, (New York, 1996).

[76] James Aley, "The Economy," Fortune (January 10, 1994).

[77] Susan Schwartz, "The Future is Here--Insurance Adapts Leading Edge Technology," Insurance and Technology (November 1995).

[78] Alan Levinsohn, "Will Insurance Profit from Telecom Reform," Insurance and Technology (January 1996).

In a client-server environment, imaging applications can be used to reduce paperwork and speed workflow, particularly in the claims processing area. Multiple users and locations allows both senior management and field personnel to access and view claims information in ways that help them do better analysis and problem solving.[80]

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[79] Katherine Burger, "Slowly but Surely, Insurers Edge Away from the Mainframe," Insurance and Technology (June 1995).

[80] Katherine Burger, "Claims Processing--There's Got to be a Better Way," Insurance and Technology (April 1995).

CHAPTER SIX:
PROFESSIONAL SERVICES

Chapter in Focus

Workers employed in the Professional Services industries have extremely specialized skills. Demand for these specialized skills has driven the dramatic growth in professional services. Increased international competition has created more opportunity in foreign markets and sparked the need for bilingual and multilingual workers.

Occupations nominated as emerging or evolving within the Professional Services industries include:

Data Acquisition and Verification Technician
Electronic Research Technician
Litigation Support Specialist
Meeting/Event Planner
Phone Poller/Interviewer

Also included here are more general emerging and evolving occupations which span the Professional Services industries:

Computer Network Specialist
Computer Programmer
Computer Support Technician
Customer Support Specialist
Data/Information Specialist

Chapter in Detail

Individuals employed in professional services can aptly be called knowledge workers. Professional service occupations are distinguished from the lower paying and transitional occupations in the service sector in general. Knowledge workers in the professional services sector are to today's economy what production/manufacturing workers were to the previous economy. These workers, regardless of the level of education attained, have extremely specialized skills. The demand for these specialized skills has driven the dramatic growth in professional services. Knowledge workers account for over 33% of total employment in the United States.[81]

When employment of these workers rises, it also portends a surge in the demand for the tools of their trade--computers, information services, and cell phones to name a few. The increased use of these tools has resulted in increased productivity, reduced costs, and improved turnaround time. Local area networks, electronic bulletin boards, and customized software are becoming integral to professional services firms as well.[82]

U.S. professional services firms are extremely competitive, and have an advantage--sometimes based on cost, other times based on expertise or reputation--in many sectors internationally. U.S., Japanese, and European professional services firms are all pursuing contracts aggressively in Europe, the largest regional market outside the United States. These firms also seek to take advantage of the marketing opportunities that have recently been opened to them in Eastern Europe and the countries formerly comprising the Soviet Union. In addition, demand for professional services is increasing in the Far East. The best opportunities in this burgeoning market are in Japan, Taiwan, and the Association of South East Asia Nations member countries: Brunei, Indonesia, Malaysia, the Philippines, Singapore, and Thailand.[83]

Engineering, Accounting, Research, Management, and Related Services

Engineering, Accounting, Research, Management, and Related Services (SIC 87) includes firms primarily engaged in providing engineering, architectural, and surveying services; accounting, auditing, and bookkeeping services; research, development, and testing services; and management and public relations services.[84]

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[81] Nuala Beck, Shifting Gears: Thriving in the New Economy (New York: Harper Collins, 1995).

[82] Nuala Beck, Shifting Gears: Thriving in the New Economy (New York: Harper Collins, 1995) and U.S. Department of Commerce, U.S. Industrial Outlook 1994: Forecasts for Selected Manufacturing and Service Industries (Washington, D.C., January 1994).

[83] U.S. Department of Commerce, U.S. Industrial Outlook 1994: Forecasts for Selected Manufacturing and Service Industries (Washington, D.C., January 1994).

[84] Industry categories under SIC 87 include SIC 8711-Engineering Services; SIC 8712-Architectural Services; SIC 8713-Surveying Services; SIC 8721-Accounting, Auditing, and Bookkeeping Services; SIC 8731-Commercial Physical and Biological Research; SIC 8732-Commercial Economic, Sociological, and Educational Research; SIC 8733-Noncommercial Research Organizations; SIC 8734-Testing Laboratories;

(continued...)

Accounting, Auditing, and Bookkeeping. Large and small CPA firms are utilizing accounting paraprofessionals to meet their staffing needs. There are significant savings in the salaries of paraprofessionals when compared to those of professionals. In addition to lower hourly rates, very few paraprofessionals work full-time. The result is a significant reduction in fringe benefit costs, greater flexibility in scheduling work during peak periods, and a decrease in non-billable hours. The level of education of paraprofessionals varies--some possess a knowledge of bookkeeping, others have associate degrees in accounting, and a significant number have baccalaureate degrees in accounting. As an alternative to remaining a paraprofessional, some of these individuals continue their education, become eligible to sit for the CPA exam, and join the professional ranks.[85]

Engineering and Architecture. The combined industry sector of engineering and architecture has one of the highest ratios of knowledge workers. As the economy improves, engineers and architects will be in demand for construction of petrochemical and semiconductor factories and prisons.[86]

Management and Public Relations. This sector provides information and expertise to a variety of clients on a contractual basis. There are five main categories: management (business and construction management); management consulting (marketing, personnel, and administrative consulting); public relations (including lobbyists); facilities support (base maintenance, jail, and prison management); and other consulting services.[87]

The rapid growth in the number of management consultants has sparked fierce competition for market share. In an effort to survive, firms have expanded their range of services and their areas of specialization. Information technology is the fastest growing area of specialization. Because of the bright outlook in this sector, firms in other areas of activity are entering the market. Prime examples of these new consulting spin-offs are the computer hardware manufacturer International Business Machines (IBM) with IBM Consulting and the accounting firm Arthur Andersen through its affiliate Andersen Consulting. Each has created an information technology consulting entity in recent years with Arthur Andersen becoming the leader in this activity.[88]

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[84](...continued)
SIC 8741-Management Services; SIC 8742-Management Consulting Services; SIC 8743-Public Relations Services; SIC 8744-Facilities Support Management Services; and SIC 8748-Business Consulting Services, Not Elsewhere Classified. .

[85] U.S. Department of Commerce, U.S. Industrial Outlook 1994: Forecasts for Selected Manufacturing and Service Industries (Washington, D.C., January 1994).

[86] Michael Parrish, "Industry by Industry Outlook," LA Times (January 1, 1995) and Nuala Beck, Shifting Gears: Thriving in the New Economy (New York: Harpers Collins, 1995).

[87] U.S. Department of Commerce, U.S. Industrial Outlook 1994: Forecasts for Selected Manufacturing and Service Industries (Washington, D.C., January 1994).

[88] U.S. Department of Commerce, U.S. Industrial Outlook 1994: Forecasts for Selected Manufacturing and Service Industries (Washington, D.C., January 1994).

Services, Not Elsewhere Classified

Services, Not Elsewhere Classified (SIC 89) includes services not classified under other unique SIC codes.[89] See the section on Professional Services for more detail.

Legal Services

Legal Services (SIC 81) includes establishments which are headed by members of the bar and are engaged in offering legal advice or legal services.[90] Private partnerships and sole-proprietor law offices are the principal organizations in the legal services sector, accounting for about two-thirds of all practicing attorneys. Roughly one-third of all lawyers practice law outside the legal services sector--in corporations, banks, trade associations, government agencies, and legal aid societies. Most lawyers are in general practice, but increasingly, many specialize in fields such as tax, civil rights, environmental, and intellectual property law.[91]

The legal profession, still undergoing fundamental changes resulting from the economic downturn of 1990-91, as well as attempting to address the financial excesses of the 1980s, has had to look for new ways of doing business. Cost-conscious clients, litigation reform, technology, and other factors have reduced the demand for legal services, forcing firms to trim their staffs, pare their expenses, and utilize new technology to become more efficient and competitive.[92] An approach being utilized in many areas of professional services to reduce litigation is alternative dispute resolution (ADR). ADR is one facet of a major rethinking that is underway regarding the effectiveness of the judicial process. It avoids interference with business operations and productivity and preserves confidentiality of information which would become public in a court trial. Both parties commit to this process to make it effective and they must decide whether to pursue arbitration or mediation.[93]

The legal professional also is being impacted by new technologies. In civil cases, the use of videotaped depositions has increased. In both civil and criminal cases, considerable effort is expended on transforming evidence in written exhibits or oral testimony into multimedia presentations (such as simulations and graphical reenactments) to capture the attention of and more effectively persuade jurors. Thus litigation support specialists no longer confine their activities to law library research and witness interviews; rather, they now may have to have technical training in audio and video recording and editing and/or computer graphics and simulation.

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[89] Industry services included under this major SIC group include Actuaries; Advertising; Announcers; Art Restoration; Artificial Nucleation; Artists' Studio; Artists; Authors; Chemists; Christian Science Lecturers; Cloud Seeding; Consultants; Entomologists; Geologists; Ghost Writing; Greeting Cards; Inventors; Lecturers; Music Arrangers; Newspaper Columnists; Physicists; Psychologists; Radio Commentators; Sculptors' Studios; Song Writers; Stained Glass Artists; Weather Forecasters; Weather Modification; and Writers.

[90] The detailed industry category included under SIC 81 is SIC 8111-Legal Services.

[91] U.S. Department of Commerce, U.S. Industrial Outlook 1994: Forecasts for Selected Manufacturing and Service Industries (Washington, D.C., January 1994).

[92] David Frum, "Lawyers in Cyberspace," Forbes (October 25, 1993).

[93] U.S. Department of Commerce, U.S. Industrial Outlook 1994: Forecasts for Selected Manufacturing and Service Industries (Washington, D.C., January 1994).

CHAPTER SEVEN: TELECOMMUNICATIONS

Chapter in Focus

Extremely rapid technological change is occurring in the communications field. New compression technologies and broadband transmission are opening new possibilities for interactive communication. Wireless service firms will offer a practical alternative to the telephone, including cellular phones and paging. Although voice transmission accounts for the vast majority of current wireless revenues, many industry observers predict that within just a few years data transmission will account for about one-half of all wireless revenues.

The proliferation of digital satellite transmission capacity will facilitate the widespread introduction of high-density TV and the information highway. Satellites also transmit the bulk of U.S. distance learning services for corporations and schools. Satellite-delivered applications include cellular telephony, positioning and navigation services, and digital radio.

Occupations nominated as emerging or evolving within the Telecommunications industry include:

Multimedia Specialist
Alternative or related titles include: Computer Graphics Technician, Desk Top Publishing Specialist/Operator, Multimedia Software Designer, Multimedia Specialist, Plug and Play Internet Application Developer, and Print and Graphics Imaging Technician.

Wireless Communications Technician
Alternative or related titles include: Cellular Phone Installer, Cellular Technician, Personal Communications Services Specialist, Radio Communications Technician, and Wireless Data Transmissions Technician.

Other industry-related occupational areas include:

Carrier Frame Relay Services Specialist
Direct Broadcast Service Satellite Technician
Fiber Optics Technician
Videoserver Technician

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Chapter in Detail

Communications (SIC 48) includes firms furnishing point-to-point communications services, whether intended to be received aurally or visually, and radio and television broadcasting. This major SIC group also includes firms providing paging and beeper services and those engaged in leasing telephone lines or other methods of telephone transmission, such as optical fiber lines and microwave or satellite facilities, and reselling the use of such methods to others.[94] The U.S. telecommunications industry is broadly divided into providers serving the communications markets for local exchange, long distance (toll), international, cellular and mobile radio, satellite, and data communications. *(Note this section will also cover Telecommunications Equipment produced under SIC 36. For more information about other Electrical Equipment, see the section on Electronic Equipment and Components.)*

Much has been said about the information era, where the range of information needs, sources, and suppliers is expanding and information management systems are becoming more and more sophisticated. Extremely rapid technological change is occurring in the communications field. Once distinct communications modes--for example telephone and video--are increasingly able to be delivered by a range of modes as digital streams of information. Alone or in combination, new compression technologies and broadband transmission open new possibilities for both distributive (one-way) and interactive (two-way) communication and information. These developments are seen by many as having profound implications for the way people will work, interact, educate, and entertain themselves in the future.[95]

At the industry level, major consortia and strategic alliances are being formed between cable and telephone interests, media groups, and computer hardware and software producers to respond to the new opportunities for multimedia and information services over what is popularly known as the "information superhighway." These are, for the most part, large corporations looking at global markets. Many corporations in the media industry also are examining a shift in focus from traditional broadcast services to more targeted services, resulting in a larger number of channels and content providers in the future.[96]

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[94] Check the Standard Industrial Code (SIC) Manual for more detail. Industry categories under SIC 48 include SIC 4812-Radiotelephone Communications; SIC 4813-Telephone Communications, Except Radiotelephone; SIC 4822-Telegraph and Other Message Communications; SIC 4832-Radio Broadcasting Stations; SIC 4833-Television Broadcasting Stations; SIC 4841-Cable and Other Pay Television Services; and SIC 4899-Communications Services, Not Elsewhere Classified.

[95] Australian National Board of Employment, Education, and Training--Employment and Skills Formation Council, Converging Communications and Computer Technologies: Implications for Australia's Future Employment and Skills (Australia: Australian National Board of Employment, Education, and Training, February 28, 1995).

[96] Australian National Board of Employment, Education, and Training--Employment and Skills Formation Council, Converging Communications and Computer Technologies: Implications for Australia's Future Employment and Skills (Australia: Australian National Board of Employment, Education, and Training, February 28, 1995).

Telephone Services. Telephones continue to be a valuable and cost-effective service for American consumers and businesses. Despite all the talk about the telecommunications take-off, the traditional components of the business, like telephone calls, still account for a bulk of the profits.[97] Long distance networks now are nearly 100% fiber optic, although the carriers utilize satellite and microwave circuits for backup and special facilities applications. Both local and long distance carriers are either investing in or evaluating applications using digital technologies for wireless communications networks, including point-to-point microwave links and wireless access technologies such as cellular. Digital technology is making rapid advances in wired and wireless communications and is lowering the cost of transmitting information. Hence, there are new ways to construct local networks and provide services in a local telephone market.[98]

In most states local exchange competition is barred by statute. However, there are signs that competition is making its way into this last bastion of monopoly in the telephone network. The development and implementation of radio-based technologies (wireless services) may enable new companies to offer competitive services in the local exchange market. Cellular and personal communications service providers may soon be in a position to capture a significant share of the local access market for traditional voice and low-rate data transmission.[99]

Cable TV companies are likely to compete with the local telephone companies in the near future.[100] Cable companies already have connections with over 60% of U.S. households, and cable facilities extend into areas where another 30% of the households are located. New digital and fiber optic technologies will allow them to provide telephone services over their networks, something cable companies already are doing in Britain.[101]

Development of broadband technology has become a critical issue for the local exchange companies.[102] With such a platform in place, telephone companies would be in a position to offer

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[97] "Hot and Cold Industries," Fortune (January 16, 1995) and Standard and Poor's, Industry Surveys (New York, 1996) and Nuala Beck, Shifting Gears: Thriving in New Economy (New York: Harpers Collins, 1995).

[98] U.S. Department of Commerce, U.S. Industrial Outlook 1994: Forecasts for Selected Manufacturing and Service Industries (Washington, D.C., January 1994) and Richard Handford, "The Shape of Things to Come," Financial Times (October 3, 1996).

[99] U.S. Department of Commerce, U.S. Industrial Outlook 1994: Forecasts for Selected Manufacturing and Service Industries (Washington, D.C., January 1994).

[100] Standard and Poor's, Industry Surveys (New York, 1996).

[101] U.S. Department of Commerce, U.S. Industrial Outlook 1994: Forecasts for Selected Manufacturing and Service Industries (Washington, D.C., January 1994).

[102] Philip Manchester, "Bandwidth Gap Needs Bridging," Financial Times (October 3, 1996) and "Alan Cane, "Era of the Information Society," Financial Times (October 3, 1996).

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video services and add new revenue sources. Although high quality digital communications networks already criss-cross the U.S., it is often the "last mile," the connection from a local switching office to a customer's residence, that forms the barrier to providing end-to-end digital connectivity.[103]

Wireless service firms will offer a practical alternative to the telephone local copper wire for reaching the residential and small business customer. In the larger metropolitan areas, competitive access providers will continue to attract large businesses that seek more economical ways to connect to their long distance carrier. Cable companies will begin to offer interactive home services and, in some cases, residential phone service to compete with the local telephone company.

Telephone Services--Long Term Outlook. Total revenues from local exchange services reached $85 billion in 1994 and are forecast to grow to $95.5 billion by 1998. The market for local telephone service will grow steadily at a rate of about 3% annually for the next several years, but market structure will change as competition increases. Since conventional telephone service promises only limited future growth, the Regional Bell Holding Companies and other large Local Exchange Carriers (LECs) are looking for strategic opportunities in such areas as the cellular telephone, paging, electronic publishing, and cable TV businesses.

U.S. long distance carriers are expected to generate toll revenues of about $73 billion by 1998 compared with about $58 billion in 1994. Possible deregulation allowing long distance carriers into the local exchange market could pose more competition for LECs but substantial gains for long distance carriers hoping to capitalize on consumers' desires to purchase all their phone services from one provider. The ability to provide one-stop shopping would be a powerful draw for consumers.[104] The number of E-mail users should increase by about 40% over the next few years.[105]

Network Equipment. Network equipment is included in SIC 3661, encompassing both telephone and telegraph apparatuses. The network equipment market in the United States is evolving to meet the changing demand for services by users. Most of the embedded base of local exchange carrier equipment is designed to handle voice traffic. The fastest growing areas of telecommunications traffic, however, are in high-speed data communications and video traffic. A variety of technological approaches have been developed to meet these demands. Three of the most promising are frame relay, switched multimegabit data service, and asynchronous transfer mode.

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[103] U.S. Department of Commerce, U.S. Industrial Outlook 1994: Forecasts for Selected Manufacturing and Service Industries (Washington, D.C., January 1994).

[104] Standard and Poor's, Industry Surveys (New York, 1996).

[105] U.S. Department of Commerce, U.S. Industrial Outlook 1994: Forecasts for Selected Manufacturing and Service Industries (Washington, D.C., January 1994).

One of the fastest growing segments of the network equipment market is fiber optics. Proponents of the information highway envision a system that will provide voice, data, text, and video to a variety of users. Fiber optic cable provides the bandwidth necessary to delivery these services. A single strand of fiber optic wire, no thicker than human hair, can transmit a thousand times more information than all radio frequencies combined. A number of new fiber optic networks are in various stages of planning and construction. In addition to telephone companies and cable operators, electric utilities are expanding their use of fiber optic cable and want to become part of the information highway. Utilities already have extensive fiber optic systems in place, used primarily for internal communications.[106]

Customer Premises Equipment. Customer premises equipment (CPE), or terminal equipment, is a generic term that refers to privately owned telecommunications equipment attached to the telecommunications network, including telephones, key systems, fax machines, modems, voice processing equipment, and video communication equipment. In particular, voice processing equipment (including both voice messaging and voice response equipment) and video communications equipment (including teleconferencing equipment and videophones) have shown very strong growth. These software-intensive products have been well received in the United States because they improve business productivity by reducing communications and travel expenses. The long-term outlook for CPE is favorable through 1998. Shipments of voice processing equipment and video communications equipment will drive this growth, while shipments of telephones, fax machines, and modems will decline at varying rates. CPE equipment will continue to become more compatible with computing equipment. Personal communicators will become an increasingly viable commercial CPE product group. These graphically-driven devices combine voice, data, and fax functions and enable users to send, store, and receive information over either wireline or wireless networks.[107]

Cellular and Radio Services. The 1990s have been characterized by record-breaking growth in most wireless service segments, including cellular, paging, and specialized mobile radio. This thriving personal communications market, which is considered to have enormous growth potential through the year 2000 and beyond, was given momentum in 1993 by a series of legislative and regulatory developments encouraging emerging wireless technologies. Cellular and paging are the two largest segments of the present day wireless services market. Largely driven by declining equipment costs, the cellular industry has begun to attract users from the consumer market at a higher rate. The paging industry also has seen remarkable growth, despite being one of the oldest wireless telecommunications technologies. Growth is being driven by declining costs of service and subscriber equipment, as well as the availability of advanced services.[108]

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[106] Standard and Poor's, Industry Surveys (New York, 1996) and Scott Pendleton, "Head of Sprint Foresees a Legion of Technologies," The Christian Science Monitor (April 15, 1993) and Michael Kenward, "Light Relief for Today's Long Distance Telephone Links," Financial Times (October 3, 1996).

[107] U.S. Department of Commerce, U.S. Industrial Outlook 1994: Forecasts for Selected Manufacturing and Service Industries (Washington, D.C., January 1994) and Standard and Poor's, Industry Surveys (New York, 1996) and Nuala Beck, Shifting Gears: Thriving in the New Economy (New York: Harpers Collins, 1995).

Revenues for the cellular industry should continue to increase as higher capacity digital networks are implemented and new service offerings such as messaging become available during the next few years. A consortium of cellular operators, in conjunction with IBM, has developed an open protocol for wireless data communications, dubbed Cellular Digital Packet Data (CDPD). CDPD allows digital information to be sent over cellular voice channels by dividing data into packets that are transmitted when a voice channel is vacant between conversations or during silent periods. Potential uses of the technology include: transaction-oriented services, such as credit card verification, fleet management, inventory control, and emergency messaging; interactive services such as dial-up data and remote LANs; and multicast services providing access to on-line and subscription information sources and private bulletin boards.[109]

A number of developments since 1992 have interesting implications for the future structure and growth of the paging industry. The most significant trend for the future of the industry is the increasing number of non-business users. The mass consumer market is a new one for paging. Carriers will pursue it aggressively through retail marketing and special promotions. Another recent phenomenon is the use of paging by cellular subscribers as a means of screening calls. Because it is much less expensive to receive a page than an incoming cellular call, cellular users find it more economical to give out their pager number and return only the most urgent cellular calls. Despite lower monthly revenues per pager, reflecting cost declines and more heated price competition, predictions are that industry revenues will continue their upward trend of about 20% annual growth. This will be due to increased capacity and the introduction of new services, the latter including national and international paging, two-way messaging, and data services. Paging is well positioned to capture part of the potentially huge wireless data market, especially with the increased use of alphanumeric pagers. Telocator, the paging industry's trade association, developed the Telocator Data Protocol (TDP) in 1993. In addition to voice mail and subscriber services (such as news and weather updates), TDP will allow pagers to interact with personal computers to send data quickly and at low cost. This will make it attractive to small and medium-sized companies who cannot afford the higher-priced two-way wireless data services.[110]

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[108] U.S. Department of Commerce, U.S. Industrial Outlook 1994: Forecasts for Selected Manufacturing and Service Industries (Washington, D.C., January 1994) and Standard and Poor's, Industry Surveys (New York, 1996).

[109] U.S. Department of Commerce, U.S. Industrial Outlook 1994: Forecasts for Selected Manufacturing and Service Industries (Washington, D.C., January 1994) and Standard and Poor's, Industry Surveys (New York, 1996).

[110] U.S. Department of Commerce, U.S. Industrial Outlook 1994: Forecasts for Selected Manufacturing and Service Industries (Washington, D.C., January 1994).

Cellular and Radio Services--Long Term Outlook. The U.S. cellular market will reach an estimated 35 million subscribers by 2000. Paging subscribers and revenues are forecast to continue near the 20% growth rate, aided by the wide availability of alphanumeric paging and subscriber information services, as well as by the possible introduction within this forecast period of two-way messaging. Although voice transmission accounts for the vast majority of current cellular revenues, many industry observers predict that within just a few years data transmission will account for about one-half of all cellular revenues, amounting to more than 10 million users. [111]

One marketing research forecast expects nearly 15 million personal communications services (PCS) users in the U.S. by the end of the decade. Other forecasters predict that PCS revenues will approach $14 billion in 1999 and that more than half of all communications will involve some form of wireless component within the next 10 years. Broad area coverage and low cost are the two most important considerations for consumer acceptance of PCS. Another significant consideration is the ability for consumers to control when and where to receive calls. Although PCS is most often associated with voice applications, perhaps its most significant potential will be the utilization of its broadband, digital, high-speed qualities to transmit massive amounts of data and information. The development of smaller cell sizes will mean less costly, lighter-weight handsets with batteries that can last for days instead of hours.[112]

Data transmission is expected to comprise an ever increasing portion of the future wireless market. Growth will be driven by 1) increasing market penetration of portable computers and personal organizers; 2) the introduction of new products incorporating radio frequency modems; 3) broader user familiarity with networking; 4) the development of mobile data protocols; and 5) greater expectations about personal accessibility to information. Although precise market estimates vary widely, it seems clear that PCS is poised for success. In addition, as the introduction of PCS further expands competition and service offerings in the wireless arena, the growth rate of all wireless services is expected to increase, similar to the effect cellular development has had on the paging industry. Ultimately, the launching of widespread consumer-oriented PCS will likely change both the way society communicates and the way it views communications for the foreseeable future.[113]

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[111] U.S. Department of Commerce, U.S. Industrial Outlook 1994: Forecasts for Selected Manufacturing and Service Industries (Washington, D.C., January 1994).

[112] U.S. Department of Commerce, U.S. Industrial Outlook 1994: Forecasts for Selected Manufacturing and Service Industries (Washington, D.C., January 1994) and Standard and Poor's, Industry Surveys (New York, 1996).

[113] U.S. Department of Commerce, U.S. Industrial Outlook 1994: Forecasts for Selected Manufacturing and Service Industries (Washington, D.C., January 1994) and Standard and Poor's, Industry Surveys (New York, 1996).

Satellite Services. Growth in satellite services has been steady, punctuated by the introduction of direct-to-home satellite broadcasting services and rapidly increasing international traffic via satellite. Mobile satellite service revenues, although small relative to overall industry income, continues to boom as existing companies expand service offerings and numerous new ventures enter the dynamic mobile satellite services arena.[114]

Satellites using fixed earth stations--or fixed satellite services--include broadcasting, data transmission, and telephony. The bulk of current domestic satellite capacity is used for video transmission; terrestrial cable and fiber optics carry most domestic voice and data telephone services. Wider use of digital compression techniques will effectively increase already expanding domestic satellite capacity by making more efficient use of available radio frequencies. Direct broadcasting satellite (DBS) services--beaming television signals directly to viewers at home--promise to challenge cable TV by offering viewers hundreds of channels carrying cable superstations, pay-per-view movies, sports programming, and specialized educational and entertainment programming, using satellite dishes as small as 18 inches and significantly cheaper than the much larger versions. Full implementation of domestic DBS will have an enormous impact on the U.S. domestic satellite services market. The proliferation of digital satellite transmission capacity through the advent of DBS will facilitate the widespread introduction of high-density TV and the information highway. Satellite technology's accessibility to remote areas, its distance-insensitivity, and its ability to be rapidly deployed have encouraged its use for specialized narrowcasting applications for educational and corporate programming. Private business television is one of the fastest-growing sectors. Satellites also transmit the bulk of U.S. distance learning services for corporations, primary and secondary, and postsecondary schools.[115]

Land mobile satellite services (LMSS) have driven the mobile satellite service industry's dynamic growth. LMSS includes satellite-delivered applications such as cellular telephony, positioning and navigation services, and digital radio. LMSS proponents capitalize on the acknowledged efficiency and safety offered by mobile services such as cellular telephony, and the added enhancement of complete nationwide and eventually global coverage.[116]

Global Positioning System. The first commercial service revenues began to flow from Global Positioning System (GPS) services in 1993. GPS, a 24-satellite constellation operated by the Department of Defense, reached full global coverage for its navigational and positioning services in July of 1993. GPS provides a signal with accuracies of about 100 meters for such industries as delivery services, surveying, trucking, and nautical navigation and air traffic control. Relying on satellites rather than ground stations makes the system far more precise than conventional navigation technology. While GPS signals are available to commercial users without charge, several U.S. companies have introduced value-added services to enhance the accuracy of GPS, producing signals for subscriber fees.[117] Newer GPS receivers can be hand-held or linked to a laptop computer. Essentially a GPS receiving unit locks onto any satellite within its range, receiving signals from it to calculate a person's longitude, latitude, and altitude often within 25 meters. A GPS receiver can also determine speed, direction, and length of time to destination.[118]

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[114] U.S. Department of Commerce, U.S. Industrial Outlook 1994: Forecasts for Selected Manufacturing and Service Industries (Washington, D.C., January 1994).

[115] U.S. Department of Commerce, U.S. Industrial Outlook 1994: Forecasts for Selected Manufacturing and Service Industries (Washington, D.C., January 1994).

[116] U.S. Department of Commerce, U.S. Industrial Outlook 1994: Forecasts for Selected Manufacturing and Service Industries (Washington, D.C., January 1994).

Because of their small size and accuracy, GPS systems are the salient equipment for air, land, and sea navigation.[119] GPS can steer boaters around dangerous reefs and help pilots avoid midair collisions. By combining GPS with computerized maps, car and truck manufacturers are developing electronic road atlases installed in the dashboard that can provide directions to tourists, truckers, and delivery personnel.[120] Car navigation equipment can range from simple locating equipment to complex route guidance. These systems provide early route recommendations, suggest alternative routes in case of traffic accidents, and improve safety. Future systems will have voice output that will release the driver from having to view a monitor.[121] Combining GPS tracking capability with sophisticated scheduling software allows delivery companies to provide specific delivery times to customers.[122] Still another example of GPS application is in the construction industry. A GPS receiver is mounted on a bulldozer or other construction vehicle and feeds information to the vehicle and the driver. When grading at a particular site is initiated, the GPS monitors the progress and guides machine operators using a TV-like monitor in the vehicle's cab.[123]

Geographic Information System. Digital geographic information systems (GIS) are a unique combination of spatial feature representations and analyses in digital format and the more traditional data base information that describes or quantifies the spatial feature or features. Spatial features are located with respect to a known coordinate system and are represented as a point, line, or polygon.

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[117] U.S. Department of Commerce, U.S. Industrial Outlook 1994: Forecasts for Selected Manufacturing and Service Industries (Washington, D.C., January 1994).

[118] Mark Lewyn, "Where Am I? Ask a Satellite," Business Week (October 26, 1992).

[119] Bruce Nordwall, "Upgrades and Civil Avionics to Counter Budget Squeeze," Aviation Week and Space Technology (March 20, 1989).

[120] Time Magazine (October 21, 1991).

[121] Dan Holt, "Car Information Systems," Automotive Engineering (August 1995).

[122] Mitch Betts, "Software Combo Cuts Delivery Guesswork," Computerworld (March 27, 1995).

[123] Kathleen Wiegner, "Space-Age Bulldozers," LA Times (December 28, 1994).

These spatial features are then further described by a record in a database. A point feature might represent for example the location of an oil or gas well that can be associated to a database record containing information on well installations related to production and servicing.[124]

GIS mapping software maintains a database of information that can visually portray locations of specific sites or the interrelatedness of specific sites. GIS relies on images or photographs developed through remote sensing using satellites or airplanes. Site images are digitized and the data are used to develop software packages.[125]

Satellite Equipment. Satellite communications systems consist of a space segment--the communications satellite (comsat) that both receives and transmits signals--and a ground segment that includes earth stations for both transmitting and receiving signals, and equipment for tracking, telemetry, and control. Throughout the 1990s, geostationary comsats will face aggressive competition with expanding terrestrial and fiber optic networks for point-to-point transmission of domestic, regional, and international communications services. Advances in satellite manufacturing technology and wider use of digital compression techniques by the late 1990s will extend the operational lifetimes and enhance the spectrum efficiency of individual satellites, translating into fewer, but more powerful and sophisticated, satellites needed to meet service demand.[126]

Ground satellite communications systems consist of manufacturers of both fixed satellite earth stations and mobile receivers for the transmission and reception of data, video, and voice signals via satellite. Video applications created the largest segment of demand for U.S.-made satellite ground equipment in 1993. Although mobile satellite receivers have contributed only a relatively small portion of total U.S. ground segment revenues, they promise explosive growth as mobile satellite service applications (like GPS and GIS) develop in the mid- and late-1990s. Continued international demand and innovative satellite television and mobile satellite ventures will sustain U.S. satellite industry revenues throughout the late 1990s.[127]

If regulatory and financial hurdles are cleared, significant new space and ground segment revenue streams will emerge by the late 1990s to supply constellations of small satellites used for cellular-like services and positioning data. Moderate growth in fixed ground segment revenues will be bolstered by strong demand for receivers for direct broadcast satellite television. As new mobile satellite services are phased in, mobile satellite receiver sales will expand much faster than their fixed counterparts, with an emphasis on small, portable hand-held and vehicle-mounted receivers.[128]

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[124] Rodney Stoa, "PCS Ease Geographic Oil and Gas Data Base Visualization," Oil and Gas Journal (September 25, 1995).

[125] Rodney Stoa, "PCS Ease Geographic Oil and Gas Data Base Visualization," Oil and Gas Journal (September 25, 1995).

[126] U.S. Department of Commerce, U.S. Industrial Outlook 1994: Forecasts for Selected Manufacturing and Service Industries (Washington, D.C., January 1994).

[127] U.S. Department of Commerce, U.S. Industrial Outlook 1994: Forecasts for Selected Manufacturing and Service Industries (Washington, D.C., January 1994).

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[128] U.S. Department of Commerce, U.S. Industrial Outlook 1994: Forecasts for Selected Manufacturing and Service Industries (Washington, D.C., January 1994).

CHAPTER EIGHT: TRANSPORTATION

Chapter in Focus

Regional airline growth will continue to outpace that of the larger carriers because of increased consumer demand and a continuation of the shift of selected routes from the large air carriers to the regional carriers. The air cargo industry is expected to maintain a brisk rate of growth through the remainder of this decade and beyond due to economic expansion in countries around the world and a growing reliance on air carriage for the shipment of electronic components and other goods. The telecommunications industry will have significant impact on passenger air flight by continuing its development of ground-to-air communications via phones, computers, and faxes as well as live television, shopping, and computer games.

More waterway shippers are incorporating the use of computers to assist with navigation, scheduling, and shipment information and well as turning to third-party logistics experts to provide warehousing, distribution, and inventory management. Shippers are also exploring the use of the Internet to make shipping information and schedules available to customers. With ports increasingly being called on to accommodate higher volumes of container traffic, they must implement improvements both on the land and water sides. Some experts suggest that ports may also find a competitive edge by offering more services to shippers.

Occupations nominated as emerging or evolving within both the Air and Water Transportation industries:

Navigation/Mapping/Surveying Specialist
Alternative or related titles include: Geographic Information System Specialist, Geographic Information System Cadastralist, and Global Positioning Systems Technician.

Inventory/Warehousing/Logistics Specialist

Occupations nominated as emerging or evolving within the Air Transportation industry:

Air Transport Technician
Avionics Technician/Aviation Mechanic
Noise Abatement Technician

Chapter in Detail

Transportation experts predict nearly half a million people will be needed to fill new jobs in the United States transportation industries by 2005. By 2005, employment is expected to reach 4.7 million, up from 4.3 million in 1990. The air transport sector is expected to comprise 35% of all transport workers by 2005, while ocean and inland waterway employees will make up 7% of the transportation workforce.[129]

Transportation by Air

Transportation by Air (SIC 45) includes firms providing domestic and foreign air transportation and those operating airports and flying fields and providing terminal services.[130]

U.S. airlines, buffeted by major financial losses that began in 1990, struggled to regain profitability in 1993 and develop long-range stability. Total profits for the industry (passenger and freight) are now increasing, primarily due to a surge in passenger traffic, implementation of the North American Free Trade Agreement (NAFTA), and the development of a single European market.[131] Although economic deregulation and costly government regulations and taxes were blamed for many of the industry's earlier financial problems, some airlines managed to prosper. For example, while some major carriers found themselves in dire financial straits, a few smaller newcomers, influenced by the continued profitability of Texas-based Southwest Airlines, successfully carved out niche markets. Unlike the traditional full-service airlines, Southwest has experienced steady growth, consistent profitability, and satisfied customers.[132]

Traffic has grown briskly for regional and commuter airlines. Forecasts call for increased passenger miles among point-to-point regional/commuter carriers which will continue to outpace growth for the major airlines during the remainder of this decade. Affiliations formed with the larger airlines should continue to spur traffic growth, as the regional/commuters have become an important part of the industry's hub-and-spoke system.[133]

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[129] Gregory S. Johnson, "Need a Job? Transport May be the Place to Look," Journal of Commerce and Commercial (January 14, 1994). The largest increase nationwide will come in the trucking sector, projected to account for 42% of all transport workers by 2005. The next fastest growing segment will be the air transport industry, which is expected to comprise 35% of all transport workers by 2005. By 2005, ocean and inland waterway employees will make up 7% of the transportation workforce, with rail workers comprising 6%

[130] Industry categories under SIC 45 include SIC 4512-Scheduled Air Transportation; SIC 4513-Air Courier Services; SIC 4522-Nonscheduled Air Transportation; and SIC 4581-Airports, Flying Fields, and Airport Terminal Services.

[131] "Hot and Cold Industries," Fortune (January 16, 1995) and James Peltz, "Industry by Industry Outlook," LA Times (January 1, 1995) and Ira Rosenfeld, "Banner Year for Transport," Journal of Commerce and Commercial (January 9, 1995).

[132] Perry Flint, "The Road Not Taken," Air Transport World (March 1994).

[133] Standard and Poor's, Industry Surveys (New York, 1996).

Modest long-term growth is expected in domestic air traffic. Scheduled air transportation is expected to grow 19.5% in Texas through the year 2000. Nonscheduled air transportation, including ambulance carriers, helicopter carriers, charter services, and sightseeing planes, will increase 68.6% in Texas through the year 2000.[134] Regional airline growth will continue to outpace that of the larger carriers because of increased consumer demand for low-cost travel and a continuation of the shift of selected routes from the large air carriers to the regional carriers.[135]

U.S. carriers expect even greater gains in international traffic.[136] Boeing projects average annual growth in world air traffic of 5.9% from 1994 through 2000, falling to 4.9% in the period from 2000 to 2013. Using Boeing's projections, the world air traffic market would double by 2000 and nearly triple by 2013. The company projects that expanded air traffic will account for about 75% of the demand for new equipment, with replacements of older equipment providing the balance. In the aftermath of recent highly publicized airplane crashes, increased attention to safety and maintenance in selection of air carriers may lead some firms to replace the older planes in their fleets with new ones. Replacements also will come from planes that cannot be refitted to conform to the noise regulations imposed by the Federal Aviation Administration.[137]

The telecommunications industry will have significant impact on passenger air flight by continuing its development of In-Flight Entertainment, or IFE. The possibilities of IFE are seemingly endless, and include global satellite ground-to-air communications via phones, computers, and faxes as well as live television and radio, shopping, gambling, and computer games. The next decade will see an explosion of game technology and evidence indicates it will be as popular in coach as it is in first class. By 2005 most of the technological kinks in these applications should be resolved.[138]

Although airlines may face increasing fees for fuel under strengthened environmental regulation, [139] manufacturers anticipate a move toward larger jumbo aircraft in coming years. Aircraft with more than 350 seats will account for about 23% of manufacturing deliveries during the period between 1994 to 2013, compared with only 8% during the period between 1975 to 1993. The trend toward larger aircraft is due to the increasing congestion of airports and airways, as well as changes in travel patterns and increasing global travel demands.[140] Establishments engaged in operating and maintaining airports and flying fields and in providing airport terminal services are expected to grow 31.5% in Texas through the year 2000.[141]

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[134] Texas Employment Commission industry projections data from 1993 to 2000.

[135] U.S. Department of Commerce, U.S. Industrial Outlook 1994: Forecasts for Selected Manufacturing and Service Industries (Washington, D.C., January 1994).

[136] U.S. Department of Commerce, U.S. Industrial Outlook 1994: Forecasts for Selected Manufacturing and Service Industries (Washington, D.C., January 1994).

[137] Standard and Poor's, Industry Surveys (New York, 1996).

[138] Kieran Daly, "A Changing Game Plan," Airline Business (August 1995).

[139] James Aaron Cooke, "What the "Newt" Congress Means for Shippers," Traffic Management (January 1995).

Air Cargo. The air cargo industry is expected to maintain a brisk rate of growth through the remainder of this decade and beyond. Factors that bode well for this sector of airline transportation include economic expansion in countries around the world, broader service offerings, and a growing reliance on air carriage for the shipment of electronic components and other goods. Growth in the air cargo market has been fueled by the rise of air express carriers. Several factors have contributed to the rapid expansion of this particular service, including: the growing need for speedy delivery of original documents and other packages in an information and service-based economy; the development of centralized distribution systems; the adoption of just-in-time inventory and production systems; and the willingness of shippers to pay for such services. As the U.S. air express market has matured, carriers have turned to service refinements and enhancements as competitive tools.[142]

Water Transportation

The U.S. Water Transportation industry (SIC 44) consists of deep sea transportation of both U.S. foreign trade and domestic cargoes (including passengers), as well as shipments of cargo in the Great Lakes, the St. Lawrence Seaway, the inland waterways, and local waters. Deep sea foreign and domestic water transportation includes three service categories: general cargo, dry bulk, and liquid bulk. General cargo operations, predominantly movements of finished and semi-finished goods, usually are performed by vessels operating as common carriers in regularly scheduled liner service. Dry bulk cargoes, such as grain, coal, ore, and some wood products, move in specialized vessels under contract or by proprietary carriage. Liquid bulk cargoes, primarily crude oil and refined petroleum products, are carried in tankers and tanker barges. This major SIC group also includes excursion boats, sightseeing boats, and water taxis.[143]

Deep Sea Foreign Transportation. The U.S. foreign trade liner fleet is composed of general cargo and intermodal ships. General cargo ships include breakbulk vessels, partial containerships, and other ships designed to carry noncontainerized cargo. Intermodal ships primarily consist of containerships, roll-on/roll-off vessels, and container/barge carriers. Like their foreign counterparts, U.S. shipping companies are cutting costs to improve profits, and implementing new technologies and other methods to increase productivity. Despite these steps, reduced economic activity around the world and continuing overcapacity have caused considerable deterioration in the liner freight markets. Liner shipping companies continue to enter into vessel and terminal sharing agreements to offset rising costs associated with liner operations. Such arrangements permit companies to use capital more efficiently by sharing costly assets and offer expanded market opportunities through increased sailing frequencies and port coverage.

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[140] Standard and Poor's, Industry Surveys (New York, 1996).

[141] Texas Employment Commission industry projections data from 1993 to 2000.

[142] Standard and Poor's, Industry Surveys (New York, 1996).

[143] Industry categories under SIC 44 include SIC 4412-Deep Sea Foreign Transportation of Freight; SIC 4424-Deep Sea Domestic Transportation of Freight; SIC 4432-Freight Transportation on the Great Lake--St. Lawrence Seaway; SIC 4449-Water Transportation of Freight, Not Elsewhere Classified; SIC 4481-Deep Sea Transportation of Passengers, Except by Ferry; SIC 4482-Ferries; SIC 4489-Water Transportation of Passengers, Not Elsewhere Classified; SIC 4491-Marine Cargo Handling; SIC 4492-Towing and Tugboat Services; SIC 4493-Marinas; SIC 4499-Water Transportation Services, Not Elsewhere Classified.

Tanker operators' performance has been influenced by an increase in operating costs in order to comply with the requirements under the Oil Pollution Act of 1990; new environmental laws restricting emissions and waste disposal; a significant rise in insurance premiums to cover oil pollution clean up costs; and poor freight rates.

Deep Sea Foreign Transportation--Long Term Outlook. While there is a movement toward jumbo containerships and larger global transportation operators, there is still room for smaller and more flexible niche players.[144] Line shipping operators will continue to offer more frequent sailings and faster transit times to meet the just-in-time inventory delivery system used by U.S. manufacturers. Industry experts suggest that simplifying paperwork and developing common processing systems between shippers would speed transactions. The emergence of logistics information solution providers, "contract logistics," has allowed more shippers to turn to third-party logistics experts who can provide a single, neutral, and integrated database which can be accessed on a real-time basis by all trading partners. While shippers traditionally have relied on paperwork, phone, and faxes to communicate schedule and shipment information to customers, the advent of consistent and cooperative access to common information databases can provide a competitive edge to manufacturing, distribution, and other transportation partners as they realize their functions are inherently interdependent. If significant cost and service efficiencies are to be achieved, it will be increasingly important that logistics information flow cross-functionally throughout the supply chain.[145] The contract logistics aspect of the transportation industry is expected to grow from $25 billion in 1996 to $50 billion in 2000. A contracts logistics firm can offer third-party warehousing, distribution, and inventory management services. Sometimes these services are listed as manufacturing support, and then can include minor subassembly, sequencing of production parts, management of returnable containers, and de-trashing, the last being the removal of packaging from goods destined for the production line.[146] Some shippers also are exploring the use of the Internet to make shipping information and schedules available to customers.[147]

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[144] Leo Ryan, "Legion of Challenge Confronts Global Transport into Next Century," Journal of Commerce and Commercial (June 21, 1994).

[145] "Views from the Boardroom--Forecasts of the Shipping Industry," Journal of Commerce and Commercial (January 8, 1996).

Carriers are likely to give higher priority to improvements in transit time between the United States and Southeast Asia due to the migration of manufacturing from Japan to Korea, Taiwan, and other Southeast Asia locations where labor costs are lower. Export growth should average higher than import growth, due to expected improvement in the competitiveness of U.S. electronics, machinery, audio, video, and office equipment.[148]

Additionally, with larger ships making fewer port calls, ports must accommodate higher volumes of container traffic with improvement both on the land and water sides. Since port calls are time consuming for shippers, they will place even greater demands on the rail and truck transportation availability at ports to take care of final distribution.[149] According to industry experts, the three top issues that will continue to have an impact on the port industry are financing capital projects to handle capacity requirements, dredging requirements to keep waterways open, and environmental issues. Some experts suggest that ports may need to start competing more on service rather than on pricing, which should reap rewards in the long run.[150] In Texas, water transportation services, including marine cargo handling, towing and tugboat services, marinas, and other services are expected to grow by 16.9% through the year 2000.[151]

Domestic Water Transportation. Section 27 of the Merchant Marine Act of 1920, commonly referred to as the Jones Act, requires that all waterborne commerce between points in the U.S., including its territories and possession, be carried on vessels built in the United States, and owned and crewed by American citizens. Domestic oceanborne trade includes noncontiguous trade between the United States mainland and Alaska, Hawaii, Puerto Rico, Guam, Wake, and Midway; trade between the Great Lakes and the three ocean coasts; and the intercoastal trade between the Atlantic or Gulf and Pacific coasts by way of the Panama Canal. Shipments among U.S. ports and connecting waterways, inland waterways movements, and offshore oil supply boat operations also are included in domestic trade.

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[146] Brian Johns, "Logistics Service Surge as World Trade Booms," Journal of Commerce and Commercial (January 8, 1995).

[147] Allen R. Wastler, "Five Trends Remaking Shipping," Journal of Commerce and Commercial (January 8, 1996).

[148] U.S. Department of Commerce, U.S. Industrial Outlook 1994: Forecasts for Selected Manufacturing and Service Industries (Washington, D.C., January 1994) and James Aaron Cooke, "What the 'Newt' Congress Means for Shippers," Traffic Management, (January 1995).

[149] Allen R. Wastler, "Five Trends Remaking Shipping," The Journal of Commerce and Commercial (January 8, 1996).

[150] "Views from the Boardroom--Forecasts of the Shipping Industry," Journal of Commerce and Commercial (January 8, 1996).

[151] Texas Employment Commission industry projections data from 1993 to 2000.

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Domestic Water Transportation--Long Term Outlook. The outlook for the deep sea domestic freight industry is closely linked to conditions in the national economy. In addition, the costs of transporting crude oil and petroleum products are expected to rise as companies initiate actions to meet the provisions of the Oil Pollution Act and the Clean Air Act Amendments. Under the requirements of these laws, operators must replace single-hulled barges with double-hulled barges and install vapor recovery piping systems to reduce petroleum and petrochemical vapors during cargo loading.

On the inland waterways, long-term improvements will depend on the movement of additional tonnage that could result from the resolution of current agricultural subsidy disputes with U.S. trading partners and increased coal exports. NAFTA should have a positive impact on the inland waterways industry because of North-South shipments of grains, oils, and steel.[152] Water transportation of freight is expected to grow by 61% in Texas through the year 2000.[153] Industry experts do caution that new ways of doing business must be developed by shippers in order to stay competitive and meet customer demand.[154] Many of these new ways of doing business are focused on the customer, including tailoring transportation to specific loads, better storage and distribution solutions, and partnerships.[155]

Intermodal transportation, the fastest growing segment of the railway industry utilizing multiple carriers, appeared for a while to be a speedier delivery alternative over pure trucking for waterway shippers.[156] But while intermodal brings speed, it does not necessarily bring efficiency. Shippers complain about reliability and the difficulty intermodal carriers have had in handling recent increases in demand. Mode capacity is a major concern of shippers who use vessel sharing agreements. Vessel sharing agreements are partnerships between carriers which offer the benefit of expanded frequency and service into a particular area without having to invest in a new ship. These agreements allow carriers to arrive in port with more containers from more sources, but which then require distribution in all directions rather than the traditional shipment of containers concentrated on one railroad line. Shippers will be increasingly reluctant to commit their inventories to intermodal transportation as the quality gap between intermodal and truck carriage widens in favor of truckers.[157]

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[152] U.S. Department of Commerce, U.S. Industrial Outlook 1994: Forecasts for Selected Manufacturing and Service Industries (Washington, D.C., January 1994).

[153] Texas Employment Commission industry projections data from 1993 to 2000.

[154] "Views from the Boardroom--Forecasts of the Shipping Industry," Journal of Commerce and Commercial (January 8, 1996).

[155] George Adcock, "New Rules Needed for 21st Century," Global Trade and Transportation (June 1994).

[156] Leo Ryan, "Legion of Challenge Confronts Global Transport into Next Century," Journal of Commerce and Commercial (June 21, 1994).

Another development in the transportation industry with significant impact on inland and domestic shipping is the application of Global Positioning System (GPS) technology. The St. Lawrence Seaway expects to be the first inland waterway in North America to use the technology, starting in 1997. One application, the Vessel Tracking Services system, will allow traffic controllers to schedule transits more effectively. Under the present system, ships periodically radio in their positions to traffic control centers. With GPS there is the capacity for real-time display of exact positions within 25 feet compared to half a mile. This system will not replace pilots or engineers aboard vessels but will be a considerable tool. Besides increasing efficiency in traffic control and reducing incidents and transit time, the system also is designed to enhance environmental protection.[158]

Still other developments are being pursued by shippers to remain competitive. Niche markets exist for transporting U.S.-Mexico commerce in a hybrid craft, known as a river-ocean vessel, that can go through the shallow drafts of a river system and the deeper waters of the Gulf of Mexico. River-ocean vessels, characteristically ranging from 1,500 to 3,000 deadweight tons, are not currently in use on the U.S. inland waterway system and Gulf of Mexico. But gearless, single hatch, and often high-tech versions of the vessel are used widely in Europe and Russia to carry a variety of small quantity cargoes. River-ocean vessels could offer savings to the U.S., compared to rail or barge-to-barge sea vessel shipment. Exporters favor the idea of river-ocean vessels, because water transportation is still cheaper than overland transportation.[159]

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[157] Ira Rosenfeld, "Industry Heads into a Curve," Journal of Commerce and Commercial (May 9, 1995).

[158] Leo Ryan, "Vessel Tracking System Called Wave of the Future," Journal of Commerce and Commercial (August 29, 1994).

[159] Tim Sansbury, "Study Touts Hybrid Vessel to Carry U.S. Goods to Mexico," Journal of Commerce and Commercial (January 6, 1994).

CHAPTER NINE:
UTILITIES

Chapter in Focus

Independent smaller power producers are adopting and refining emerging technologies, such as fuel cells and solar cells, that can be placed in a customer's home. Home computers will allow customers to program their air conditioning and heating to turn on when demand is low and rates are less expensive. Utilities will increase their emphasis on developing and utilizing renewable energy technology for power capacity growth and for environmentally cleaner energy production.

The United States is the world's largest producer and consumer of environmental goods and services. The environmental equipment and services industry is expected to continue to grow in response to the public's demand for a cleaner environment. The demand for environmental monitoring of gas emissions, water purity, and the ozone layer presents exciting opportunities for growth.

Occupations nominated as emerging or evolving within the Energy and Utilities industry:

Air Monitoring/Emissions Technician
Alternative Fuels Technician/Hybrid Fuel Technician
Chemical Safety Technician
Decontamination Technician
Environmental Quality Specialist
Hazardous Materials Removal Worker
Home Energy Efficiency Auditor
Reclamation/Reuse Technician
Utilities Plant Technician/Operator
Water Quality Specialist

Other major industry occupational clusters include:
Energy Conservation
Recycling and Restoration
Remediation of Environmental Contamination
Renewable Energies
Solid and Hazardous Waste Management

Chapter in Detail

Electric, Gas and Sanitary Services (SIC 49) includes firms engaged in the generation, transmission, and/or distribution of electricity, gas, or steam. These establishments may be a combination of any of the services above as well as other services, such as transportation, communications, and refrigeration. Water and irrigation systems, and sanitary systems engaged in the collection and disposal of garbage, sewage, and other wastes by means of destroying or processing materials, also are included.[160] *(Note this section will also cover electric and renewable energy equipment produced under SIC 36. For more information about other electrical equipment, see the section on Electronic Equipment and Components.)*

Energy/Utility Services. Economic growth, the Organization of Petroleum Exporting Countries' (OPEC) behavior, production and export rates of crude oil from republics of the former Soviet Union, and increased environmental concerns and regulations are expected to be the basic forces behind energy markets through 1998. Industry experts predict that worldwide oil consumption will rise 2.7% a year for the rest of the decade. Growth rates in energy consumption will be more rapid in developing countries than in the industrialized world, because of higher economic and population growth rates in developing countries. Asia is likely to continue to have the fastest growth in consumption. Rich nations will increase their petro-appetites as well, as the fervor for energy conservation cools somewhat. "Fuel hogs" are back in trend, including jeeps, minivans, and trucks. Assuming no major disruptions in the market, increased demand equals higher prices and greater profitability.[161]

Electric Services. Industrial production and the construction industry are the primary factors influencing electrical and renewable energy products.[162] With deregulation meant to spur competition,[163] independent smaller power companies have emerged to challenge the larger and more traditional utility plants. These independent power producers (IPPs) are building cleaner, more innovative, and more efficient plants. IPPs have lead the way in transforming the economies of scale that have traditionally shaped the industry, opening up a new era of decentralized power generation--perhaps even allowing individual home owners to generate their own power. New telecommunications technologies may link millions of these smaller power generators and even household appliances into one "smart" power system. Like the telecommunications industry, the electricity industry is confronting increased competition and rapid technological change. These pressures could pave the way for more efficient and environmentally sound power systems. But to get there, expect electric utilities to undergo radical restructuring similar to the one that transformed the telephone industry.[164]

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[160] Industry categories under SIC 49 include SIC 4911-Electric Services; SIC 4922-Natural Gas Transmission; SIC 4923-Natural Gas Transmission and Distribution; SIC 4924-Natural Gas Distribution; SIC 4925-Mixed, Manufactured, or Liquified Petroleum Gas Production and/or Distribution; SIC 4931-Electric and Other Services Combined; SIC 4932-Gas and other Services Combined; 4939-Combination Utilities, Not Elsewhere Classified; SIC 4941-Water Supply; SIC 4952-Sewerage Systems; SIC 4953-Refuse Systems; SIC 4959-Sanitary Services, Not Elsewhere Classified; SIC 4961-Steam and Air-Conditioning Supply; and SIC 4971-Irrigation Systems.

[161] "Hot and Cold Industries," Fortune (January 16, 1995) and Standard and Poor's, Industry Surveys (New York, 1996).

[162] U.S. Department of Commerce, U.S. Industrial Outlook 1994: Forecasts for Selected Manufacturing and Service Industries (Washington, D.C., January 1994).

[163] Standard and Poor's, Industry Surveys (New York, 1996).

Decentralized Generation. The IPPs have been quick to adopt and refine emerging technologies. Many IPPs specialize in constructing small generators to cogenerate heat for industrial use as well as electricity. One example is the gas turbine--essentially an adapted jet engine. Jet engines burn a mixture of air and fuel, usually natural gas, to spin a turbine to thrust a plane forward. In power generation, a gas turbine is used to generate electricity, while excess heat powers a steam turbine. IPPs also have helped spearhead the use of resources such as biomass, geothermal, wind, and solar power. As these technologies improve, costs for renewable energy drop.[165]

Some of the most important advances are occurring with the smallest technologies--microgenerators such as fuel cells and solar cells. These microgenerators could allow electricity to be produced in a customer's building or home. Basement-housed fuel cells or rooftop-mounted solar cells could be linked to existing power networks reducing reliance on large-scale power generation. Fuel cells are electrochemical, battery-like devices that transform fuel efficiency into electricity with minimal air pollution and virtually no noise. Natural gas supplies the hydrogen used to power the cells. Experts predict that within a decade, costs will be low enough that new building will be equipped with natural gas-powered fuel cells that simultaneously generate electricity, heat water, and even provide air conditioning.[166]

The photovoltaic (PV) solar cell is the other promising small-scale technology and lends itself to decentralization as well. PV cells are semiconductor devices, usually made of silicon, that emit electrons when struck by sunlight, thereby producing an electric current. As costs have declined, the potential applications of PV cells have multiplied. They can be deployed on almost any scale. Some U.S. manufacturers have experimented with developing solar tiles that could become common roofing material, sheltering occupants while powering their appliances. While rooftop PV systems are used in some homes in remote locations lacking electricity, they have an even greater potential market in buildings connected to the power network grid.[167]

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[164] Christopher Flavin and Nicholas Lenssen, "Power Surge: Guide to the Coming Energy Revolution.," Technology Review (May/June 1995).

[165] Christopher Flavin and Nicholas Lenssen, "Power Surge: Guide to the Coming Energy Revolution.," Technology Review (May/June 1995) and Standard and Poor's, Industry Surveys (New York, 1996).

[166] Christopher Flavin and Nicholas Lenssen, "Power Surge: Guide to the Coming Energy Revolution.," Technology Review (May/June 1995).

Both fuel cells and solar cells have the potential to increase the overall efficiency of the power system. About a third of the cost of selling power to residential consumers comes from transmitting and distributing it. If a utility builds a small power plant in a customer's own home or building, it avoids much of that cost. Utilities can take advantage of this arrangement by purchasing excess electricity from their customers for local distribution, instead of buying it from other utilities. As these small-scale technologies are commercialized in the years ahead, the line between electricity provider and customer will fade.[168]

Smart Utilities. Integrating small-scale generators into the network power system grid will be made easier with two-way communication technologies to monitor and control the power system down to the level of the individual home appliance. Each coal plant, fuel cell, and air conditioner could be linked to a utility's computers so that the grid operates as a single "smart" system, turning generators and appliances on and off as needed. This linking can take place over the fiber optic cable systems utilities now use to provide communications between dispatchers and their power plants. Home computers will provide the two-way communication, and allow customers to program their air conditioning, washing machines, and other devices to turn on when demand is low and rates are less expensive. This electronic communication between suppliers and consumers will become increasingly important with the emergence of more and more decentralized microgenerators. A "smart" power system can use price information to fine-tune the balance between electricity supply and demand, increase the efficiency of these new technologies, and reduce costs throughout. Since energy management requires no more than 5% of the capacity of a fiber optic cable, a utility could lease the bulk of its capacity to other companies providing other information, education, and entertainment services.[169]

Electric Services--Long Term Outlook. As further legislation weakens the monopolies enjoyed by the large centralized power plants, the IPPs could increase their market share dramatically. Over the next two decades, increased competition will speed the exploration and adoption of new technologies. These restructured local utilities will be service-oriented, providing a diverse array of cost-effective energy services.[170] In Texas, establishments providing a combination of utility services are expected to grow by 50% through the year 2000, while businesses providing air conditioning services are expected to grow by 100% through the year 2000.[171]

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[167] Christopher Flavin and Nicholas Lenssen, "Power Surge: Guide to the Coming Energy Revolution.," Technology Review (May/June 1995).

[168] Christopher Flavin and Nicholas Lenssen, "Power Surge: Guide to the Coming Energy Revolution.," Technology Review (May/June 1995).

[169] Christopher Flavin and Nicholas Lenssen, "Power Surge: Guide to the Coming Energy Revolution.," Technology Review (May/June 1995) and Standard and Poor's, Industry Surveys (New York, 1996).

Power, Distribution, Specialty Transformer, and Switchgear Equipment. Demand for power and distribution transformers and switchgear equipment comes primarily from expansion and maintenance in the electric utility industry and from new housing starts. The continued decline in electricity prices is expected to result in the demand for more electric capacity.

Motor and Generator Equipment. The Department of Energy (DOE) and the Environmental Protection Agency (EPA) have joined forces in a program called the Motor Challenge, to develop a voluntary and industry-driven collaborative program. The program aims at galvanizing U.S. business and industry to develop and demonstrate efficient electric motor systems. Industry partners are invited to participate and to voluntarily make efficiency upgrades. The federal agencies provide technical and organizational support and training. The DOE states that the Motor Challenge program has the potential of saving U.S. industries as much as $3 billion annually by the year 2000 and nearly $13 billion annually by 2010. As an added benefit, DOE estimates that electric motor system upgrades through participation in the program potentially can reduce carbon emissions by 10 million metric tons annually by the year 2000 and 44 million tons by 2010. High-efficiency motors will continue to be in demand as energy and environmental concerns remain a high priority for consumers. The motor and generator industry is expected to register growth at a compound annual rate of 4 to 5 percent between 1994 and 1998.

Renewable Energy and Electrical Equipment. Renewable energy electrical equipment produces electricity from resources that are replenished or regenerated by natural forces, such as sunlight, wind, cellulosic and organic wastes, water currents, and the earth's surface heat. Utilities have increased emphasis on "integrated resource planning" for power capacity growth and on environmentally clean energy technologies. Continued or accelerated double-digit annual increases in U.S. domestic and export sales of solar photovoltaic cells are projected between 1995 and 1999 based on increased rural electrification in developing countries and plans by major U.S. utilities to use solar photovoltaics in peak power, demand-side management, and distributive offset projects. Favorable trends promising increased growth in the geothermal sector include a decline in geothermal energy costs because of technological advances and production efficiencies; utilities' increasing purchase of renewable energy; rising demand in the western states where U.S. geothermal resources are located; and access to utility transmission lines. Trends in the United States also indicate accelerated growth in the domestic wind-power market.[172]

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[170] Christopher Flavin and Nicholas Lenssen, "Power Surge: Guide to the Coming Energy Revolution.," Technology Review (May/June 1995).

[171] Texas Employment Commission industry projections data from 1993 to 2000.

Gas Services. U.S. consumption of natural gas is expected to rise due to stronger economic growth and increasing gas-fired generating capacity. In Texas, gas production and distribution is expected to grow by 18.8% through the year 2000.[173] Growth in demand is supported by an increase in interstate pipeline capacity. Increased demand by electric utilities and by the industrial sector account for nearly all of the increase in natural gas demand. Domestic production of natural gas is expected to increase only slightly, with the remainder of supply coming from imports, mainly Canadian. The continuing increase in imports from Canada has been made possible by the rapid growth in import pipeline capacity.[174]

Increased dependence on foreign oil, together with environmental concerns, has focused attention on the use of natural gas to supply a greater portion of the United States' energy requirements. The growing use of gas-fired electricity generators will trigger a global boom for natural gas and infrastructure construction.[175] The continued expansion of U.S.-Canada pipelines, as well as interstate pipelines, assures that sufficient pipeline capacity will be available to meet record U.S. demand for natural gas in 1998. Electricity generation and cogeneration will account for much of the projected growth in natural gas consumption.[176]

Sanitary Services. The commercial and non-governmental environmental/conservation services such as recycling are best discussed here under Sanitation Services. The United States is the world's largest producer and consumer of environmental goods and services, accounting for over 40% of the world market.[177] The environmental equipment and services industry is expected to continue to grow in response to the public's demand for a cleaner environment. The surging demand for environmental monitoring equipment for gas emissions, water purity, and the ozone layer presents exciting opportunities for growth.[178] Increasingly, industry has discovered that cleaner manufacturing processes not only mitigate waste and pollution but heighten cost savings and competitiveness, leading to adoption of more environmentally sound technologies on a voluntary basis.

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[172] U.S. Department of Commerce, U.S. Industrial Outlook 1994: Forecasts for Selected Manufacturing and Service Industries (Washington, D.C., January 1994).

[173] Texas Employment Commission industry projections data from 1993 to 2000.

[174] U.S. Department of Commerce, U.S. Industrial Outlook 1994: Forecasts for Selected Manufacturing and Service Industries (Washington, D.C., January 1994) and Standard and Poor's, Industry Surveys (New York, 1996).

[175] Michael Parrish, "Industry by Industry Outlook," LA Times (January 1, 1995) and Standard and Poor's, Industry Surveys (New York, 1996).

[176] U.S. Department of Commerce, U.S. Industrial Outlook 1994: Forecasts for Selected Manufacturing and Service Industries (Washington, D.C., January 1994) and "Hot and Cold Industries," Fortune (January 16, 1995).

[177] "Alchemy of Sludge," Financial Times (February 22, 1995).

Water and Wastewater. As the largest segment of the environmental industry worldwide, water pollution abatement focuses on purification of groundwater/wastewater and reclamation. Filters and clarifiers remove solid particles, biological treatment and chlorination remove bacteria, and reverse osmosis/chemical recovery systems remove chemical and metal compounds.[179] New wastewater and sewage treatment technologies continue to replace, where reasonable, conventional activated carbon adsorption, incineration, and air stripping systems that merely transfer pollutants from one medium to another [180] Establishments engaged in distributing water for domestic, commercial, and industrial use are expected to grow in Texas by 76.4% through the year 2000.[181]

Solid Waste/Recycling. Waste management encompasses products and services for collecting and transporting solid waste, treating and disposal of toxic waste, landfills, and recycling. In Texas, establishments engaged in collecting and disposing of waste and refuse, including hazardous waste, are expected to grow by 63.6% through the year 2000.[182]

Texas has agreed to accept hazardous waste from other states for disposal. This not only creates jobs at the potential disposal sites for hazardous waste and environmental safety technicians, but also may add to the training needs of persons engaged in the transportation of these materials.

The trend in U.S. sanitary landfill practices is towards fewer but bigger solid waste sites. Landfill sites today require sophisticated design and construction procedures, quality assurance/control oversight and documentation, and rigid monitoring and reporting of site operations. Landfills in all states are required to have liner systems. Similarly, final cover or cap designs involving multiple layers to minimize infiltration of surface water into the retardation layer, and to support vegetation, are now required nationally. Monitoring of ground water and gas surrounding landfills is mandated nationwide. Hazardous waste presents another set of problems--and potential solutions. The hazardous waste management industry involves a wide variety of services which are purchased by industry and government to address hazardous waste problems. The industry is driven by complex and technical laws and new rules probably will emerge as the Clean Water Act and Superfund are reauthorized. New techniques and technologies for treating and disposing of waste are in the testing stage and could ultimately reshape this critical industry.[183]

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[178] Nuala Beck, Shifting Gears: Thriving in the New Economy (New York: Harpers Collins, 1995).

[179] U.S. Department of Commerce, U.S. Industrial Outlook 1994: Forecasts for Selected Manufacturing and Service Industries (Washington, D.C., January 1994).

[180] "Alchemy of Sludge," Financial Times (February 22, 1995).

[181] Texas Employment Commission industry projections data for 1993 to 2000.

[182] Texas Employment Commission industry projections data for 1993 to 2000.

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[183] "Alchemy of Sludge," Financial Times (February 22, 1995).

CHAPTER TEN:
WHOLESALE TRADE--DURABLE GOODS

Chapter in Focus

Wholesalers are now offering more value-added services and utilizing technologies to improve navigation, productivity, reliability, and service quality. Much of this can be done by accessing satellite-driven navigation applications and implementing bar coding and a system of electronic data interaction to assure next-day delivery, product lot tracking, and comprehensive inventory controls.

The demand for consumer durables should increase, particularly in the areas of home theater and related equipment, CD players, large-screen television, and high-quality loud speakers.

Occupations nominated as emerging or evolving within the Wholesale Trade industry include:

Navigation/Mapping/Surveying Specialist
Alternative or related titles include: Geographic Information System Specialist, Geographic Information System Cadastralist, and Global Positioning System Technician.

Inventory/Warehousing/Logistics Specialist

Chapter in Detail

Wholesale Trade of Durable Goods (SIC 50) includes firms engaged in the wholesale distribution of durable goods.[184] The wholesale industry, a large and diverse sector of the U.S. economy, sells both raw materials and manufactured products. It is highly fragmented, consisting of a few large companies and many small firms.

Traditionally, wholesalers and distributors have added value through efficient performance of two primary activities: selling and physical distribution. The products that wholesalers distribute to their customers are supplied by other firms in the manufacturing, mining, agricultural, and wholesale sectors of the economy. Wholesalers may sort, assemble, grade, and store goods. Some also provide certain "value added" services, such as packaging and labeling--a business strategy that is becoming increasingly important as thousands of wholesalers, selling products that are similar in quality and design, compete for customers.[185]

The structural changes that continue to take place in distribution channels are forcing wholesalers to reexamine and readjust their strategies for maintaining a competitive edge, including reorienting their services and product mix. A survey of more than 700 manufacturing and distribution executives conducted by the National Association of Wholesale-Distributors, and compiled in the report, *Facing the Forces of Change 2000*, concluded that to meet the challenges of the 1990s, wholesalers must improve and expand value-added services, improve productivity, expand geographically, enlarge existing lines, diversify into new product lines, and develop new markets.[186]

Wholesalers are now offering more value-added services and utilizing technologies to improve productivity, reliability, and service quality--in short, whatever it takes to keep the customer satisfied. Much of this can be done by implementing bar coding and a system of electronic data

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[184] Industry categories under SIC 50 include SIC 5012-Automobiles and Other Motor Vehicles; SIC 5013-Motor Vehicles Supplies and New Parts; SIC 5014-Tires and Tubes; SIC 5015-Motor Vehicle Parts, Used; SIC 5021-Furniture; SIC 5023-Homefurnishings; SIC 5031-Lumber, Plywood, Millwork, and Wood Panels; SIC 5032-Brick, Stone, and Related Construction Materials; SIC 5033-Roofing, Siding, and Insulation Materials; SIC 5039-Construction Materials, Not Elsewhere Classified; SIC 5043-Photographic Equipment and Supplies; SIC 5044-Office Equipment; SIC 5045-Computers and Computer Peripheral Equipment and Software; SIC 5046-Commercial Equipment, Not Elsewhere Classified; SIC 5047-Medical, Dental, and Hospital Equipment and Supplies; SIC 5048-Ophthalmic Goods; SIC 5049-Professional Equipment and Supplies, Not Elsewhere Classified; SIC 5051-Metals Service Centers and Offices; SIC 5052-Coal and Other Minerals and Ores; SIC 5063-Electrical Apparatus and Equipment, Wiring Supplies, and Construction Materials; SIC 5064-Electrical Appliances, Television, and Radio Sets; SIC 5065-Electronic Parts and Equipment, Not Elsewhere Classified; SIC 5072-Hardware; SIC 5074-Plumbing and Heating Equipment and Supplies; SIC 5075-Warm Air Heating and Air-Conditioning Equipment and Supplies; SIC 5078-Refrigeration Equipment and Supplies; SIC 5082-Construction and Mining (Except Petroleum) Machinery and Equipment; SIC 5083-Farm and Garden Machinery and Equipment; SIC 5084-Industrial Machinery and Equipment; SIC 5085-Industrial Supplies; SIC 5087-Service Establishment Equipment and Supplies; SIC 5088-Transportation Equipment and Supplies, Except Motor Vehicles; SIC 5091-Sporting and Recreational Goods and Supplies; SIC 5092-Toys and Hobby Goods and Supplies; SIC 5093-Scrap and Waste Materials' and SIC 5094-Jewelry, Watches, Precious Stones, and Precious Metals.

[185] William Copacino, "The Changing Role of the Distributor," Traffic Management (February 1994) and U.S. Department of Commerce, U.S. Industrial Outlook 1994: Forecasts for Selected Manufacturing and Service Industries (Washington. D.C., January 1994).

[186] Pat Dolan, "New Realities in Wholesale Distribution," Industrial Distribution (December 1992).

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interaction to assure next-day delivery, product lot tracking, and comprehensive inventory controls. Because the costs associated with inventory are steep, reductions in inventory maintenance can dramatically reduce warehouse costs. In its annual report of the top 50 industrial distributors, Industrial Distributor magazine asked the companies' CEOs to describe the key strategies that contributed to their continued competitive strength in a nearly stagnant market. A majority of the responding CEOs cited their adoption of electronic data interaction systems, bar coding, and automation of their shipping and receiving activities. They also cited strategic alliances with their vendors, expanded geographic coverage, and more diversified product lines, mainly through mergers with other wholesale firms, as other important elements of their success.[187]

International Competitiveness. Wholesalers demonstrate their international competitiveness by establishing and maintaining a position in foreign markets and by delivering the products and services where needed, at the right time, and at a reasonable price. However, to maintain a competitive position in a foreign market, a wholesaler must continuously adjust for additional value-added services. Some are able to do this by establishing affiliated firms in foreign markets to be close to the customer. U.S. wholesalers with a large number of foreign affiliates include those handling consumer electronics and electrical appliances, professional equipment, and machinery. Investing in the newer technologies, adding services, and opening export markets in Mexico, China, and the European Community will provide wholesalers with alternative sources of market strength and raise the capital needed to improve productivity and institute the additional value-added services now being demanded by customers.[188]

> ***NAFTA may have more of an impact on wholesale trade in Texas than it will in most other states. Although the duties and tasks associated with occupational employment in this sector of the economy may change only slightly, the demand for bilingual workers probably will increase. While Spanish is the obvious candidate for the second language of English-speaking Texans in the Wholesale Trades, increased trade with Pacific Basin countries, the European Community, and the emerging Eastern European democracies also will increase demand for bilingual workers fluent in a wide variety of languages.***

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[187] U.S. Department of Commerce, U.S. Industrial Outlook 1994: Forecasts for Selected Manufacturing and Service Industries (Washington, D.C., January 1994) and Dan Gilmore and James Tompkins, "Take Control of Your Inventory," Industry Forum Supplement to Management Review (December 1994) and Claire Goodling, "Bar Codes Get High-Tech Links" Financial Times ((October 3, 1996) and Claire Goodling, "IT Helps Deliver the Goods," Financial Times (October 4, 1995) and John Johnson, "NAW Broadcast Projects Distribution's Future," Industrial Distribution (December 1995).

[188] U.S. Department of Commerce, U.S. Industrial Outlook 1994: Forecasts for Selected Manufacturing and Service Industries (Washington, D.C., January 1994).

Consumer Durables. In addition to economic recovery, trends that should spur demand for wholesale trade of consumer durables include the continued liberalization of international trade and investment and the increasing number of consumers in the age bracket of 35-54 that spend the most for consumer durable goods. For U.S. companies, the outlook is promising in niche areas such as home theater and related equipment, CD players, large-screen television, and high-quality loud speakers. Larger and higher-quality loud speakers, as well as amplifiers and other audio components, are expected to be in higher demand with the advent of home theater. The concurrent availability of digital VCRs is expected to be a key to the development of the HDTV market, because home taping of movies and video programs will be a major inducement for HDTV programming.[189] Shipments of consumer electrical goods are expected to increase in Texas by 7.6% through the year 2000. Also through the year 2000, Texas shipments of lumber and construction materials should increase by 20%, shipments of motor vehicles and parts should increase by 13%, shipments of hardware and heating equipment should increase by 8.6%, and shipments of professional and commercial equipment should increase by 7.7%.[190]

> ***Wholesale trade professionals involved in shipping electronic and other technological consumer goods may need both sales skills as well as highly technical product knowledge. Although sales ability is the essential competency, the knowledge base required is as diverse and complex as the range of new products being sold. In the sale of high technology and scientific goods, the products may be so new on the market that the wholesale professional may have to provide such support services as installation, customer support, and product upgrades.***

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[189] U.S. Department of Commerce, U.S. Industrial Outlook 1994: Forecasts for Selected Manufacturing and Service Industries (Washington, D.C., January 1994).

[190] Texas Employment Commission industry projections data for 1993 to 2000.

CHAPTER ELEVEN:
RECOMMENDATIONS AND CONCLUSIONS

The detailed examination of industries in this report is a significant contribution to the array of career guidance literature. Nowhere else have we seen such a data-driven approach to identifying targeted industries and related emerging and significantly evolving occupations. This type of descriptive analysis is more likely to interest and challenge students and adult job-seekers than the dry and context-free listings of occupational titles found in many career guidance sources. Career counselors and workforce development professionals can use this information to help students and adults interested in associate degree or other two year training programs channel their training efforts towards the most promising industries and occupations. With further investigation of the requisite skills and competencies for each of the emerging and evolving occupations identified in this report, educators, trainers, and curriculum developers can revise existing training programs and create new ones. The Texas State Occupational Information Coordinating Committee (SOICC) will report about each of these occupations in the next phase of this project.

This report can also be used by communities as an economic development tool. Local labor market analysts can adapt the research design in Appendix A and the step-by-step replication guide in Appendix B to develop a locally-relevant list of targeted industries and occupations. Communities can then assess their strengths and resources in terms of their key industries and occupations. A community with employers in one or more key industries may be able to leverage funds to revise existing training programs or develop new ones to prepare workers for employment in these key industries. A community also can cite the findings in this report or their own replicated studies to highlight its strengths in terms of local industry and a skilled workforce base to market itself to potential businesses.

Much of the leading-edge theorizing about the workplace of the future suggests that work may not be organized along occupational lines as we now know them; rather, work will more often be organized into discrete, short-term projects. Projects may be handled more often in the future by *ad hoc* teams whose members have broad skills and competencies for problem-solving. Industry-relevant skills and competencies--imparted to students by education and training providers--will prepare them for more interesting, diverse, and challenging work at high wages although they may no longer be able to classify themselves within a narrow occupational title.[191] Our initiative to identify industry clusters and their employment growth potential is more in keeping with this evolving paradigm for analyzing workplace needs than is the more traditional occupationally-oriented approach. Nonetheless, where useful, it may be appropriate to identify occupations (as groupings of knowledge bases and skills subsets) likely to be employed in the growth industries in order to provide more detailed information to education and training providers to guide their curriculum planning and development efforts.

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[191] Conversations related by Marc Anderberg of the Texas SOICC with Bob Glover of the Center for the Study of Human Resources at the University of Texas at Austin; Chris King at the Center for the Study of Human Resources at the University of Texas at Austin; and Bob Sheets at Northern Illinois University.

1) **We need to form local-state partnerships for data collection.**

Once the identification of targeted industries was complete, we began collecting nominations for candidate emerging and evolving occupations from industry experts and educators and workforce development professionals across the state. Although we received a few nominations from these stakeholder groups, the bulk of the nominations were collected from literature sources and from a bank of graduate surveys provided by the Texas State Technical College. In defining emerging and evolving occupations, the research team also had to decide what kinds of nominations to reject. The critical test for including or eliminating a nominated occupational title was whether the nomination was accompanied by an indication that the requisite duties and competencies differed substantially from those already associated with an existing title, or were completely new to the coding system.

The literature, while covering industries in detail, often does not present information in terms of specific occupational titles and related skills and competencies--yet this is the key information local workforce trainers and educators seek. Without local-state partnerships to facilitate both the ***collection*** and ***description*** of occupational nominations, this project will be forced to continue to rely on analyses of available state data and on reviews of the expert literature.

2) **True emerging occupations are rare; let's focus our efforts on the more prevalent evolving occupations.**

All research is a learning and discovery process. The same was true for this project. We found that emerging occupations are rare and difficult to identify. Occupations more frequently seem to evolve over time--some more rapidly and significantly than others. The pace of change may vary from one occupation to another yet only rarely do wholly new and virtually unprecedented occupations emerge.

> One example of an evolving occupation is computer programming. Computer programming has undergone significant changes since the days when computing machines were operated by a bank of sixteen switches set in on-off positions. Now the work of programming revolves around Fourth Generation Languages involving visual and object-oriented routines to manipulate multiple relational files simultaneously. Increased processor speeds, storage capacity, and random access memory make it possible to do things that were not part of predecessor programmers' repertoire: multi-tasking, use of digitized voice and video, and real-time error

> capturing and correction. While education and instruction designed to impart competency and proficiency in the use of these new tools and languages must be added to the curriculum for computer programming, new tools do not *per se* create an emerging occupation.
>
> Still another example of an evolving occupation is that of nursing. We may be moving rapidly from an age when medical treatments were limited to pharmacology and invasive surgical procedures to an era where nutrition and genetic manipulation are the norm. While the title for Registered Nurse has remained unchanged, the essential knowledge base and competencies are evolving significantly. In the days of pharmacological and surgical procedures, a Registered Nurse (RN) needed to calculate and monitor drug dosages. An RN also had to understand the aggregate anatomy and be capable of taking and interpreting conventional vital signs. As genetic manipulation, laser or microsurgery, and nutrition come to replace older procedures, knowledge of aggregate anatomy becomes less important than that of bio-chemistry and understanding the anatomy at the cell and subcell level (i.e. microbiology).

The desire on the part of education and training providers to categorize their programs as emerging fields is certainly understandable. The "emerging" label and an exotic-sounding title are helpful in attracting students, positioning the institution as progressive, and justifying requests for program dollars. However, the identification of emerging occupations must be driven by data rather than what sells in the marketplace to consumers.

The orientation of researchers and program marketers are often at odds. Researchers need standardization and continuity in data collection and coding. Without these, it is impossible to make comparisons across similar programs or between a program's current and historic performance. Such comparisons are essential in identifying best practices and program improvements. Researchers also value consistency and parsimony in the coding structures. Thus, a single code is preferred for an occupational field although there may be a wide range of approaches across related education and training programs.

In marketing, on the other hand, the emphasis is on differentiation. Education and training programs must accentuate their differences to recruit students. Unless a program title is attention-getting and distinctive, marketers know that prospective students may not delve into the program's detailed description or its performance data to see how it differs from its competitors. The temptation is to pack as much into the title as possible and to change names based on the slightest nuance to serve the purpose of differentiation.

Adhering to the researcher's principles of standardization, continuity, and parsimony, we are more inclined to treat most occupations as evolving rather than emerging unless the evidence is overwhelming and convincing. Nevertheless, the fact that a nominated field was not included in the list of emerging and evolving occupations does not prevent education and training providers from initiating new courses, developing new program titles, and accentuating curriculum updates in their marketing and recruitment efforts. Marketers and researchers can avoid conflict if all parties keep in mind that coding structures are intended for back room use in program planning, curriculum development, and program evaluation. While marketers are free to use research and evaluation results to promote programs after the research is completed, the research team must always remain objective and detached--at arm's length from promotional interests.

3) **We can combine empiricism with qualitative research and local wisdom for effective results.**

Through this research process we also found that there appears to be no purely empirical or quantitative process to identifying emerging and evolving occupations, although we found a strong quantitative process for identifying key industries. With changes made to the Automated Student Follow-up System, the process for identifying *emerging* occupations when they occur can become more empirical and quantitative. We feel the best method for identifying *evolving* occupations is first to select the targeted industries relevant to a particular region or community, then review the literature related to those industries and consult with industry and trade experts.

4) **We can use the Automated Student Follow-up System to assist us in identifying *emerging* occupations.**

As part of the Automated Student and Adult Learner Follow-Up System, Texas regularly contacts employers for occupational data on former students and program participants. To facilitate transforming employer-provided payroll titles to standard titles, Texas has created a large job title file. This file is used as a thesaurus to relate employer payroll titles to the Occupational Employment Statistics (OES) classification system. The thesaurus is updated annually with new occupational titles provided by surveyed employers who hired former students/participants. Because the thesaurus is updated on a regular basis with employer responses, it may represent a resource that could be used to identify new and/or emerging occupations. (Appendix B discusses in detail the Automated Student Follow System and recommendations for changes to this system to aid in identifying emerging occupations.)

5) **We can use capital-to-labor ratio analysis to understand industry change and frame important service delivery questions.**

As firms try to maximize productivity, they often opt to substitute capital investment for investment in human resources (labor). This shift in investment creates a workplace dichotomy. While firms invest more in technology and capital equipment, they also require a skilled workforce that can master new technology. These industries are willing to compensate highly skilled workers with higher wages. This is especially true for industries such as oil and gas extraction, petroleum refining, coal mining, and electronics manufacturing. On the other hand, these same industries also are laying off long time employees which are no longer necessary with the introduction of new equipment, processes, and technology.

The major exception to this trend is in the Professional Services industries, where intellectual property is more highly valued than technology. The high levels of professional and technical staff in these industries account for the relatively low levels of capital investment, while they still earn high wages. The staffing patterns of these industries, such as Securities and Legal Services, are dominated by occupations which require baccalaureate degrees or higher.

The circle of technology substitution leading to both fewer workers and more highly skilled remaining workers is a challenge to employers, the workforce, and the workforce development intermediary. From the workers' perspective, it becomes increasingly clear that mastery of required skills and dedication to lifelong learning are essential to continued employment. From the employers' perspective, the challenge is one of retraining existing workers to keep pace with technology substitution or finding new workers which have the necessary higher order occupational and workplace skills. From the workforce development intermediaries' perspective, the challenge is to identify where and how to best contribute to the match of employer skill needs and worker capabilities with often limited resources.

In this environment the workforce development intermediary faces the dilemma of resource allocation and service delivery. This service delivery question can be framed in the same logic used for human resource planning. In the strategic planning phase of operating a training program, the critical question posed is, "Do we take fewer clients than we know need services but train them in a wide range of intensive skills to move them into the realm of self-sufficiency (minimum focus-maximum impact); or do we enroll as many clients as possible and provide each of them with a modicum of services, hoping it will be enough to move them toward self-subsistence (maximum focus-minimum impact)?" Similarly framed, the choices available to the workforce development system are twofold: 1) should the education and training system focus on those occupations which are higher paying, yet represent fewer job openings and require extensive skills training, or 2) should the system focus on occupations in which there are expected to be greater numbers of job openings yet do not require more than a modicum of training and pay less than prevailing wages? There are no easy answers to these questions, although workforce development and education programs make these choices every day whether they intend to or not. These are issues which need to be discussed openly and incorporated into the planning process at the local and regional level.[192]

6) **We cannot forget about the real and continuing need for skilled artisans.**

Finally, in our quest to identify emerging and evolving occupations, we should not ignore certain limited fields where technological innovations are leading to significantly changed or even new occupations, but where there might still be demand for skilled artisans in the old technologies. Bookbinding is one example. The technology surrounding the printing and distribution system for the written word is changing at blinding speed. Traditional printing houses are falling by the wayside to be replaced by computer tools and network distribution systems. For a long time to come, however, there will be people who want to access books in the traditional form as well as refurbish valued books and family heirlooms. Another example includes watches and clocks. Newer versions of these tools require someone skilled in micro-electronics or small motor replacement. But some people still maintain older movement-type clocks and watches that require specific skills and knowledge to repair. A third example includes audio/stereo equipment. CDs have antiquated several types of recording media. But there are still significant numbers of people who have substantial investments in 33, 45, and even 78 RPM vinyl records. None of the new audio equipment tools can play these old records. Someone with investments in these older forms of entertainment needs to be able to purchase or replace turn tables, tape players, cartridges, needles, etc, or get these items tuned and repaired. As time and technology continue to produce new forms of entertainment and new tools, there will be room for significant employment opportunities with rather high wages for skilled artisans in old and traditional technologies.[193]

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[192] Unpublished notes from Richard Froeschle, Executive Director, Texas State Occupational Information Coordinating Committee.

[193] Conversation with Jay Pfeiffer, Director, Florida Employment and Training Placement Information Program, September 26, 1995.

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APPENDIX A:
METHODOLOGY FOR IDENTIFYING TARGETED INDUSTRIES AND EMERGING AND EVOLVING OCCUPATIONS

In an effort to develop a data-driven approach to identifying targeted industries and occupations instead of relying solely on anecdotal evidence, Texas SOICC staff developed a methodology that could objectively limit the scope of candidate industries and occupations. This methodology also could focus on the types of emerging and evolving occupations important to the workforce development partner agencies in Texas. Not only is it important that the methodology be empirical and objective, it also has to be replicable. While the goal of this project was to produce a list of emerging and significantly evolving occupations in Texas, local and regional labor market analysts and workforce development professionals need to be able to distill from the state list a list of occupations relevant to their communities. These concepts--empiricism, objectivity, and replicability--drove the development of the research methodology. As in any research project, staff began by developing precise definitions based on measurable characteristics.

Definitions

When initiating research, it is important to acknowledge *common-use* definitions of key concepts and to differentiate them from the *operational* definitions of those concepts as appropriate for the specific project. In this project, the definitions for both emerging and significantly evolving occupations can be depicted in levels of increasing restrictions depending upon the intended consumers of the study's results and the resources currently available to the study.

1) The literature and most lay persons might define emerging and evolving occupations broadly:

    An emerging occupation is one whose mix of duties, tasks, and requisite competencies or knowledge base does not match any occupational definition in one of the common coding systems such as the Occupational Employment Statistics Handbook (OES) or the Dictionary of Occupational Titles (DOT). Because an emerging occupation is new, efforts to apply existing titles result in a loss of information vital to both employers and educators. Employers need to crystallize related work specifications and requisite education and training requirements in order to rationally screen job applicants and to establish appropriate compensation levels. Education and training providers may need to develop new curricula.

    Most occupations evolve over time while corresponding occupational titles remain unchanged. To warrant the attention of researchers, however, the mix of requisite skills and competencies and/or the knowledge base must have changed so significantly since the last revision of the OES or DOT that the curriculum currently in use may require substantial modification and employers may need to update the job descriptions, classifications, and compensations levels for incumbent workers.

2) The least restrictive approach (above) yielded a myriad of occupations worthy of more careful attention ranging from low skill/low wage occupations which require little or no specific vocational training to very high skill/high wage jobs which may require post-doctoral education and training. A massive research effort would be required to analyze every occupation that fits the least restrictive definition -- a research design far more elaborate than available funding for this project would allow. Since the funds for this project are tied to the interests of workforce development in Texas, a more restrictive definition was used to begin winnowing the larger list to manageable proportions. In particular, the notions of occupational employment demand growth in Texas and impact on Texas' economic competitiveness were added to the definitions above for both emerging and significantly evolving occupations.

Unfortunately, these notions are tautological because occupational employment demand and an occupation's impact on the ability of Texas to compete in a global economy are two of the key *unknowns* that such research is designed to address. We proceed with this study on the assumption that occupational employment demand is derivative from industrial employment growth.[194] We also make the assumption that high wage occupational employment in key growth industries will have a greater impact on economic competitiveness than will low wage occupational employment in industries exhibiting employment declines and/or which generate relatively little spin-off occupational employment demand in other industries.[195] For these reasons, this research project used a second tier of filters to narrow the list of occupations to be studied by focusing first not on the occupations themselves, but on industries which meet one or more of the following criteria:

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[194] William D. Witter, Targeting Your Labor Market: Using Labor Market Information in Planning for Texas Jobs (Austin, TX: Texas Employment Commission and Texas State Occupational Information Coordinating Committee, 1995).

[195] Demonstrated via the Texas State Occupational Information Coordinating Committee's SOCRATES computer model using the Industry Evaluation module and the Input/Output module.

Industrial Growth Factors

- high projected percent change in employment between 1993 and 2000;[196]
- high projected absolute change in employment between 1993 and 2000;[197]

Probable Economic Competitiveness Impact Factors

- high prevailing weekly industrial wage rate;[198]
- high percentage of staffing pattern in (OES-2) professional, paraprofessional, and technical fields; and [199]
- high capital-to-labor ratio.[200]

3) Still the list of occupations derived from the application of criteria in definition two was too large relative to the resources available to this study. At this point, the narrower mission, goals, and objectives of our ***key*** customers served to further limit the scope of study. While Texas' ability to compete in the global economy may depend heavily on the skills of persons with baccalaureate and post-baccalaureate degrees, the customers of the workforce development agencies funding this project are eligible for public assistance in attaining education and training to the advanced associate degree level. A chief aim of the agencies involved is to ensure that their customers become economically self-sufficient. Moreover, in times of declining education and training dollars (relative to the eligible population), priorities must be assigned in curriculum development to those programs with the highest potential placement rates. Therefore, at this stage, we imposed the following additional restrictive criteria on both emerging and significantly evolving occupations:

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[196] Texas Employment Commission, Discovering Your Future: Industry and Occupational Projections in the Year 2000 (Austin, TX: Texas Employment Commission, 1995).

[197] Texas Employment Commission, Discovering Your Future: Industry and Occupational Projections in the Year 2000 (Austin, TX: Texas Employment Commission, 1995).

[198] Data from the Texas Employment Commission/Economic Research and Analysis database of employment and wages (ES-202) covered under the Unemployment Insurance Law.

[199] Industry staffing patterns data from by the Texas Employment Commission/Economic Research and Analysis Occupational Employment Statistics (OES) survey conducted in cooperation with the United States Department of Labor, Bureau of Labor Statistics.

[200] The capital (K) to labor (L) ratio for an industry will indicate how many dollars are allocated toward the purchase of labor (wages and salaries) for each dollar spent on capital investment (plant and equipment).

Proxy for Economic Self-Sufficiency

- The average earnings for an individual employed in the occupation must be sufficient to sustain a family of four in Texas above the poverty level as defined annually by the United States Department of Health and Human Services.[201]

Factors Pertaining to Curriculum Development Priorities

- The Specific Vocational Preparation and Training (SVPT) time required to attain the requisite competencies is within the range from six months to no more than an advanced associate degree.

- The occupation is projected to have at least 100 openings[202] in Texas per year to the year 2000 (the equivalent of five minimum sized community and/or technical college education programs with 20 projected students each).[203]

4) After imposing the criteria in the first three definitions, the list of occupations to be studied still exceeded resources. Therefore, availability of funds dictated even more restrictive definitions of emerging and significantly evolving occupations. For this definition, no new criteria need to be added. Rather, the thresholds for the measures in definition two (industrial growth factors and probable economic competitiveness impact factors) were increased in order to distill a manageable subset that could be studied adequately in this first generation study. It is hard to determine in advance where these thresholds must be set in subsequent studies.

These four levels of definition, from broad and conceptual to the pragmatism of fund-availability, can be portrayed in four concentric circles. These circles represent the methodology used to identify candidate emerging occupations. The outer circle is the broadest and is inclusive of each more restrictive definition. The second circle adds criteria related to industrial employment demand and

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[201] United States Department of Health and Human Services, Office of the Secretary, Federal Register (February 9, 1995). [Vol. 60, No. 27, pp. 7772-7774 Annual Update of the HHS Poverty Guidelines]. Note this factor is commonly used in establishing eligibility for public assistance under the state's various workforce development programs.

[202] Texas Employment Commission, Discovering Your Future: Industry and Occupational Projections in the Year 2000 (Austin, TX: Texas Employment Commission, 1995).

[203] Texas Higher Education Coordination Board, Workforce Education Program Guidelines (Austin, TX: Texas Higher Education Coordinating Board, 1995). See Program Application Procedures and Requirements: Documentation of Work Force Demand; Program Application Procedures and Requirements: Enrollment Management Plan; and New Program Review Process: Identification of Advanced and Emerging Technology Programs.

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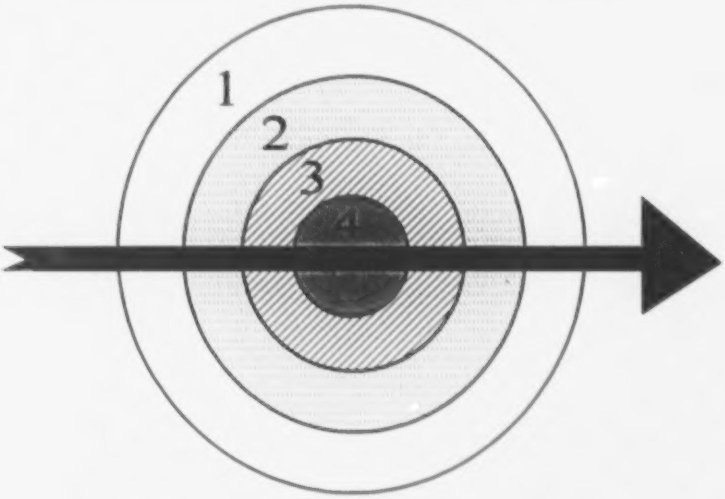
economic impact in Texas. The third circle (given the mission, goals, and objectives of the agencies funding this project and the requirement to prioritize needs in times of decreasing education and training funds) adds specific occupational earnings, openings, and training requirements.

Only the fourth and most restrictive center circle varies depending upon the availability of resources specifically for this research project (see figure below). Should an occupation fall outside of the fourth circle, we clearly will not consider it unworthy of study; but, rather, that we have insufficient resources to do the study of it justice.

MODEL OF INVESTIGATION

Concentric Circles with Increasing Restriction for Emerging Occupations;
Straight Line across All Levels of Restriction, for Evolving Occupations.
Concentric Circles are Data Driven;
Straight Line is Literature and Industry Expert Driven.



Because the identification of evolving occupations is less data-driven and quantitative, this methodology is depicted by an arrow through the center of the circles. ***No strong empirical model has been identified for the analysis of evolving occupations, though the acknowledgment of and distinction between emerging and evolving occupations is important.*** While the identification of emerging occupations will require the development of new curriculum and training programs, the identification of significantly evolving occupations will require meaningful revisions to existing curricula. Moreover, the cause of occupational evolution will become important in the curriculum revision process. The requisite skills of an occupation may evolve due to a technological innovation, which would require a modified technical training portion of that curriculum. An occupation also may evolve because of occupational restructuring. For instance, instead of working in a remote clinic under a doctor's direction with other support staff, a nurse may now compose the entire staff. A modified training curriculum for this occupation would involve reordering the requisite skills in a revised hierarchy of importance. Since the identification of significantly evolving occupations is by definition subjective, it primarily will be driven by a review of the literature with validation from key contacts. The analysis of growth industries (circle two) will provide a starting point for the literature review; application of the occupational parameters (circle three) will narrow the candidate list to meet the project's operational definitions.

Once the list of emerging and evolving occupations has been finalized for the program year, each occupation on the list must be analyzed in terms of skills and competencies. In order to be truly useful to workforce development and education professionals in their efforts to train and place students and adult job-seekers, they must have information about occupational requirements. This information is best collected from studies conducted by occupational skills analysis experts or through interviews, surveys, and focus groups with employers and industry experts.

APPENDIX B:
STEP-BY-STEP LOCAL REPLICATION MANUAL

Using the preceding Project Methodology as a framework, the following is a step-by-step documentation of the data analysis conducted during this program year. Since the project findings are applicable to the state of Texas as a whole, any city, county, or region may wish to replicate this methodology in order to develop their own locally-relevant list of targeted industries and emerging and evolving occupations. However, this step-by-step documentation is meant to serve only as a guide--each locality must adapt this process to their own community based on availability of staff and resources. Some areas may wish to acquire the data tapes, run their own reports, conduct their own mailings and electronic dialogues, and survey their own employers. Other areas may adopt a portion of the state analysis, the list of targeted industries for instance, but then compile their own lists of emerging and evolving occupations based on local employer surveys. Still other areas may wish to simply adopt a subset of the state list of occupations that works best for their program customers. Local wisdom must play a role for any community wishing to replicate this process completely or planning to adopt a portion of the state list that is relevant to the local community. To whatever extent this methodology is adopted and combined with local wisdom, the use of a data-driven and empirical process to identify targeted industries and occupations can strengthen local planning efforts.

Circle 1--Universe of Potential Emerging and Evolving Occupations

As discussed in the Project Methodology, common-use definitions of emerging and evolving occupations would yield a myriad of occupations worthy of study. For this reason, the project developed a second tier of filters to narrow the list of occupations by limiting them to industries exhibiting both employment growth and job quality.

Circle 2--Filter to Identify Growing and Economically Competitive Industries

Indicators of employment growth and job quality were added as a set of filters for analysis for Circle 2. Employment growth indicators include absolute change in predicted employment from 1993-2000 and percent change in predicted employment from 1993-2000. Job quality is predicted by economic competitiveness indicators, which include average weekly industry wage rates; percentage of staffing in professional and technical positions; and capital-to-labor ratio.

Absolute Change and Percent Change in Average Annual Employment, 1993-2000

Initial analyses of industries looked simply at gross employment projections from 1993 to 2000. Combining TEC's [204] industry projections data with a computerized reporting model developed by John Romanek at the Texas SOICC, Texas industries at the two-digit SIC level were ranked by absolute change in average annual employment from 1993 to 2000 and by percent change in average annual employment from 1993 to 2000. For example, in 1993 SIC 73-Business Services employed 470,500 persons in Texas and by 2000 is expected to employ an additional 193,600 persons for a projected total of 664,150 persons employed in this industry statewide. But while this industry employs many people, with a percent change value of only 41.14% it is not projected to grow at the same magnitude as some other industries. On the other hand, in 1993 SIC 89-Services employed only 1,900 persons in Texas and by 2000 is expected to add 1,750 additional persons--but this equals a 92.11% rate of change!

To begin grouping the industries with the highest absolute change in employment and the highest percent change in employment, the median point and quartile cutoff points were established on both lists. [205] The median point is the value that falls in the middle when measurements are arranged in ascending or descending order. [206] The median points for industries ranked by absolute change in statewide average annual employment and by percent change in average annual employment were calculated only for those industries showing employment increases from 1993 to 2000--a total of 59 industries. The industries showing declines in employment (a total of 16) were not used in calculating the median.

Since 59 industries were considered, the median point on both lists is 29.5. Rounding up, the median falls at a point on each list which translates into an absolute change in employment equal to 9,200

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[204] For each variable used in this study--absolute change in employment, percent change in employment, weekly industrial wage rate, occupational staffing patterns, and capital to labor ratio, 1993 data were collected and analyzed. While some variables have more recent data available (weekly wage rate and employment projections), other variables are based on data not updated as often (staffing patterns and capital to labor ratio). In order to make valid conclusions across the data variables for each industry, same-year data were used for every variable. Additionally, the total number of industries listed for each variable (total= *n*) varies due to data collection and reporting differences.

[205] If extreme observations exist in the data set which have a distorting effect on the average--for instance one or two very sharp employment increases or decreases-- the median measurement is preferred over the average (mean) measurement.

[206] As an example, assume there are 11 industries in Texas. We could rank them by job growth as follows:

	Industry		Job Growth
	A		8%
	B		7%
	C	quartile #1	4%
	D		3%
	E		3%
median	F	quartile #2	2%
	G		2%
	H		2%
	I	quartile #3	1%
	J		1%
	K		1%

The median, or middle, value would be 2%. The quartile cut-offs would be at 1%, 2%, and 4%.

and a percent change in employment equal to 16.67%. The top quartile for both lists ends at 14.75, and contains 15 industries. Again rounding up, the top quartile ends at a point which translates into an absolute change in employment equal to 22,100 and a percent change in employment equal to 25.00%. The second quartile for both lists ends at the point equivalent to the median point. The following Table 1 lists Texas industries ranked by absolute employment change; Table 2 lists Texas industries ranked by percent change in employment.

Table 1--Top Two Quartiles of Texas Industries Ranked by Absolute Change in Average Annual Employment 1993-2000

SIC Code	Industry Title	Absolute Change in Projected Employment 1993-2000
	Top Quartile of Industries Ranked by Absolute Change in Projected Employment	
73	Business Services	193,600
80	Health Services	171,200
93	Public Finance, Taxation, and Monetary Policy	128,000
58	Eating and Drinking Places	125,300
88	Private Households	95,050
87	Engineering, Accounting, Research, Management, and Related Services	78,000
54	Food Stores	45,950
92	Justice, Public Order, and Safety	45,450
83	Social Services	41,950
17	Construction, Special Trade Contractors	19,650
82	Educational Services	35,500
50	Wholesale Trade, Durable Goods	25,600
53	General Merchandise Stores	24,300
51	Wholesale Trade, Nondurable Goods	24,200
79	Amusement and Recreation Services	22,100

SIC Code	Industry Title	Absolute Change in Projected Employment 1993-2000
Second Quartile of Industries Ranked by Absolute Change in Projected Employment		
45	Transportation by Air	19,200
49	Electric, Gas, and Sanitary Services	15,350
75	Auto Repair, Services, and Parking	15,000
65	Real Estate	14,950
86	Membership Organizations	14,150
60	Depository Institutions	13,500
64	Insurance Agents, Brokers, and Services	13,150
72	Personal Services	13,100
42	Motor Freight Transportation and Warehousing	12,950
57	Home Furniture, Furnishings, and Equipment Stores	12,750
81	Legal Services	12,600
48	Communications	11,850
47	Transportation Services	10,200
52	Building Materials, Hardware, Garden Supply, and Mobile Home Dealers	9,300
36	Electronic and Other Electrical Equipment and Components, Ex Computer Equipment	9,200

Table 2--Top Two Quartiles of Texas Industries Ranked by Percent Change in Average Annual Employment 1993-2000

SIC Code	Industry Title	Percent Change in Projected Employment 1993-2000
Top Quartile of Industries Ranked by Percent Change in Projected Employment		
89	Misc Services	92.11%
82	Educational Services	56.57%
41	Local and Suburban Transit and Interurban Highway Passenger Transportation	43.12%
73	Business Services	41.14%
87	Engineering, Accounting, Research, Management, and Related Services	39.52%
83	Social Services	37.93%
47	Transportation Services	36.62%
79	Amusement and Recreation Services	35.56%
80	Health Services	30.98%
62	Security and Commodity Brokers, Dealers, Exchanges, and Services	30.03%
84	Museums, Art Galleries, and Botanical and Zoological Gardens	30.00%
76	Misc Repair Services	27.35%
58	Eating and Drinking Places	26.30%
75	Auto Repair, Services, and Parking	25.95%
61	Nondepository Credit Institutions	25.00%

SIC Code	Industry Title	Percent Change in Projected Employment 1993-2000
Second Quartile of Industries Ranked by Percent Change in Projected Employment		
64	Insurance Agents, Brokers, and Services	24.69%
57	Home Furniture, Furnishings, and Equipment Stores	23.68%
45	Transportation by Air	23.20%
81	Legal Services	23.10%
78	Motion Pictures	21.77%
67	Holding and Other Investment Offices	21.77%
17	Construction, Special Trade Contractors	20.99%
49	Electric, Gas, and Sanitary Services	20.40%
52	Building Materials, Hardware, Garden Supply, and Mobile Home Dealers	20.26%
08	Forestry	20.00%
54	Food Stores	18.87%
07	Agricultural Services	18.72%
44	Water Transportation	17.86%
72	Personal Services	17.82%
09	Fishing, Hunting, and Trapping	16.67%

In this research, the Texas SOICC staff examined statewide industrial employment projections. However, statewide growth in an industry's employment may not be evenly distributed across all substate regions--in fact, it may be highly concentrated. To develop regionally-valid subsets from the state list, one must assess local factors and seek confirmation by experts. Advance warning of industrial employment growth can be distilled from a variety of sources:

- Contact realtors specializing in commercial properties to see if firms have purchased or leased space for new business start-ups or expansions.
- Contact local utility companies to determine if new or expanding firms have arranged for water, sewer, gas, and/or electrical hook-ups.
- Contact municipal and county agencies which issue building permits or process zoning requests.

- Contact Chambers of Commerce and other economic development entities to determine what businesses and industries are being courted actively.

- Contact postsecondary institutions in the area to see if they have been approached by businesses inquiring about the availability of trained workers or training programs to meet growth needs.

These sources may be reluctant to give out the particular names of firms that plan to start-up or expand businesses in the community, although they may release the businesses' SIC codes. For planning and curriculum development purposes, the SIC code of the new or expanding business will serve to get the occupational employment forecasting started. Armed with the SIC code, the local planner can examine the SIC-to-OES staffing pattern matrix, review the literature, and contact industry experts to determine which occupations will be in demand and the technologies most likely to be deployed. The SOICC's SOCRATES Input/Output module can be used to assess the probable ripple affects on employment growth in other industries.

The two indicators discussed above--absolute change in employment and percent change in employment-- project which industries will grow in terms of employment demand. Much of the literature available from both public and private sources which target adult job-seekers, high school and college graduates, students making training decisions, and various career counselors and workforce development professional stops here. But these types of lists can be quite misleading without any other information about job quality within these industries. While employment growth is important, other data about wages and staffing patterns can provide a more complete picture of an industry. Only by identifying industries which promise economic competitiveness and job quality as well as employment growth can job-seekers and students make informed choices.

Therefore, this project analyzed three economic competitiveness indicators: average weekly industrial wage rate; the percentage of professional and technical occupational staffing within each industry; and the rate of investment in capital compared to the rate of investment in labor. Industries falling within the top two quartiles (above the state median) of these economic competitiveness factors are listed below in table format.

Average Weekly Industrial Wage

Average weekly industrial wage is the first economic competitiveness factor we apply to the employment growth industries. This factor will help identify those growth industries that also promise high wages. Using TEC statewide first quarter wage data for 1993 (January through March), industries at the two-digit SIC level were ranked by average weekly wage.

The median (and the end of the second quartile) point on the list of industries ranked by average weekly wage is 35, which translates into $452.57/wk or $21,723.36/yr. The top quartile consists of

18 industries, leading to a cut-off point of 17.5 which is $640.85/wk or $$30,760.80/yr. Industries included in the top two quartiles are listed in the table below.

Table 3--Top Two Quartiles of Texas Industries Ranked by Average Weekly Industrial Wage

SIC Code	Industry Title	Average Weekly Wage	Average Yearly Wage	Above the State Median of Absolute Change in Projected Employment?	Above the State Median of Percent Change in Projected Employment?
Top Quartile of Industries Ranked by Average Weekly Wages					
46	Pipelines, Ex Natural Gas	$959.27	$46,044.96		
29	Petroleum Refining and Related Industries	$944.69	$45,345.12		
13	Oil and Gas Extraction	$931.88	$44,730.24		
67	Holding and Investment Offices	$882.25	$42,348.00		Y
28	Chemicals and Allied Products	$880.97	$42,286.56		
12	Coal Mining	$859.07	$41,235.36		
49	Electric, Gas, and Sanitary Services	$796.64	$38,238.72	Y	Y
81	Legal Services	$757.14	$36,342.72	Y	Y
10	Metal Mining	$725.07	$34,803.36		
87	Engineering, Accounting, Research, Management, and Related Services	$717.52	$34,440.96	Y	Y
37	Transportation Equipment	$717.00	$34,416.00		
36	Electronic and Other Electrical Equipment and Components, Ex Computer Equipment	$711.99	$34,175.52	Y	
48	Communications	$693.12	$33,269.76	Y	
89	Misc Services	$688.15	$33,031.20		Y
45	Transportation by Air	$668.27	$32,076.96	Y	Y
35	Industrial and Commercial Machinery and Computer Equipment	$652.66	$31,327.68		
91	Executive, Legislative, and General Government, Ex Finance and Postal	$645.33	$30,975.84		
50	Wholesale Trade, Durable Goods	$640.85	$30,760.80	Y	

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SIC Code	Industry Title	Average Weekly Wage	Average Yearly Wage	Above the State Median of Absolute Change in Projected Employment?	Above the State Median of Percent Change in Projected Employment?
Second Quartile of Industries Ranked by Average Weekly Wages					
63	Insurance Carriers	$638.74	$30,659.52		
38	Measuring, Analyzing, and Controlling Instruments; Photographic, Medical, and Optical Goods; Watches and Clocks	$632.47	$30,358.56		
61	Nondepository Credit Institutions	$625.96	$30,046.08		Y
26	Paper and Allied Products	$603.62	$28,973.76		
33	Primary Metal Industries	$579.54	$27,817.92		
64	Insurance Agents, Brokers, and Services	$571.59	$27,436.32	Y	Y
51	Wholesale Trade, Nondurable Goods	$557.76	$26,772.48	Y	
16	Heavy Construction, Ex Building Construction	$555.26	$26,652.48		
44	Water Transportation	$550.30	$26,414.40		Y
14	Mining and Quarrying of Nonmetallic Minerals, Ex Fuels	$540.50	$25,944.00		
60	Depository Institutions	$521.88	$25,050.24	Y	
34	Fabricated Metal Products, Ex Machinery and Transportation Equipment	$490.06	$23,522.88		
15	Building Construction, General Contractors	$489.86	$23,513.28		
27	Printing, Publishing, and Allied Industries	$484.16	$23,239.68		
32	Stone, Clay, Glass, and Concrete Products	$480.79	$23,077.92		
30	Rubber and Plastic Products	$464.21	$22,282.08		
20	Food and Kindred Products	$452.57	$21,723.36		

One begins to see from Table 3 that not all industries which promise employment growth also promise high wages, and thus may not be a wise career investment.

Occupational Staffing Patterns Within Each Industry

Occupational staffing patterns within and across industries are the second economic competitiveness factor we apply to the employment growth industries. All personnel employed in an industry work in one of several occupations linked to that industry. Every occupation can be identified by its OES code, which in its simplest 1-digit form ranges from 1 through 9. We focused our analysis of staffing patterns on those in OES-2, Professional, Paraprofessional, and Technical occupations--because they require specific skills, training, and knowledge and therefore tend to be higher paying and more stable than occupations that in general require little or no specific skills or training. Nuala Beck in her book, Shifting Gears: Thriving in the New Economy, has created a similar gauge of employment growth by ranking industries according to their "knowledge ratio." On her scale, industries with a knowledge ratio above 40% are high, while a reading of 20%-40% is moderate. Her message is that the more skilled and educated workers an industry has, the greater the chance that industry is creating quality jobs. Although service industries like restaurants and recreation centers are creating jobs, these industries are low knowledge industries with a low percentage of skilled staffing. Hence, the jobs they create are low paying and have more turnover. Additionally, while health care accounts for much job creation nationwide, some of the explosion has been in the lower-knowledge and lower-paying jobs like personal care aide.[207]

There is some debate about using high skill occupational staffing patterns to identify economically competitive industries rather than simply identifying high technology industries themselves. Because the diversity of industries in which high skill/high technology occupations are found is far greater than the number of high technology industries, it appears wiser to consider occupational employment patterns across industries rather than focus on the specific occupational needs of any particular industry or set of industries.[208] The investment of resources and training needed to prepare individuals to enter any of the OES-2 high skill occupations--regardless of whether the industry itself is high technology--is a better economic development tool for a larger number of businesses and communities and presents much greater employment options for the local workforce.

Using TEC's OES survey data collected for the period 1991-1993, every industry at the 2-digit SIC level is summarized and ranked by its OES 2 staffing pattern. For example, the SIC 87-Services industry in Texas employs 47.74% of all its personnel in OES 2-Professional, Paraprofessional, and Technical occupations. A total of 76 Texas industries employ personnel in OES-2. The median point for Texas industries ranked by percent OES-2-Professional, Paraprofessional, and Technical Occupations is 38 or 4.5% of all personnel in that industry employed in OES-2. Industries in the top quartile employed at least 14.55% of all personnel in OES-2.

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[207] Nuala Beck, Shifting Gears: Thriving in a New Economy (New York: Harpers Collins, 1995) and James Aley, "Where the Jobs Are," Fortune (September 18, 1995).

[208] E.C. Galambos, Technician Manpower in the South: High Tech Industries or High Tech Occupations (Atlanta, Georgia: Southern Regional Education Board, 1983).

Table 4--Top Two Quartiles of Texas Industries Ranked by Percent of Staffing within OES-2

SIC Code	Industry Title	Percent of Total Industry Staffing within OES-2	Above the State Median of Absolute Change in Projected Employment?	Above the State Median of Percent Change in Projected Employment?	Above the State Median of Average Weekly Wages?
Top Quartile of Industries Ranked by OES-2 Staffing Pattern					
89	Misc Services	47.74%		Y	Y
87	Engineering, Accounting, Research, Management, and Related Services	47.10%	Y	Y	Y
81	Legal Services	46.86%	Y	Y	Y
91	Executive, Legislative, and General Government, Ex Finance and Postal	31.24%			Y
36	Electronic and Other Electrical Equipment and Components, Ex Computer Equipment	30.08%	Y		Y
38	Measuring, Analyzing, and Controlling Instruments; Photographic, Medical, and Optical Goods; Watches and Clocks	28.12%			Y
37	Transportation Equipment	27.25%			Y
13	Oil and Gas Extraction	27.00%			Y
92	Justice, Public Order, and Safety	26.87%			
61	Nondepository Credit Institutions	22.54%		Y	Y
28	Chemicals and Allied Products	21.19%			Y
08	Forestry	19.70%		Y	Not Available
63	Insurance Carriers	17.96%			Y
46	Pipelines, Ex Natural Gas	17.65%			Y
35	Industrial and Commercial Machinery and Computer Equipment	16.18%			Y
49	Electric, Gas, and Sanitary Services	16.17%	Y	Y	Y
29	Petroleum Refining and Related Industries	15.54%			Y
60	Depository Institutions	14.99%	Y		Y
67	Holding and Other Investment Offices	14.55%		Y	Y

SIC Code	Industry Title	Percent of Total Industry Staffing within OES-2	Above the State Median of Absolute Change in Projected Employment?	Above the State Median of Percent Change in Projected Employment?	Above the State Median of Average Weekly Wages?
Second Quartile of Industries Ranked by OES 2 Staffing Pattern					
93	Public Finance, Taxation, and Monetary Policy	14.51%	Y		
10	Metal Mining	14.33%			Y
73	Business Services	12.58%	Y	Y	
86	Membership Organizations	11.59%	Y		
12	Coal Mining	10.59%			Y
83	Social Services	10.54%	Y	Y	
16	Heavy Construction, Ex Building Construction	10.49%			Y
64	Insurance Agents, Brokers, and Services	9.47%	Y	Y	Y
50	Wholesale Trade, Durable Goods	8.44%	Y		Y
88	Private Households	8.40%	Y		Not Available
45	Transportation by Air	6.43%	Y	Y	Y
34	Fabricated Metal Products, Ex Machinery and Transportation Equipment	6.40%			Y
62	Security and Commodity Brokers, Dealers, Exchanges, and Services	6.40%		Y	Not Available
33	Primary Metal Industries	5.66%			Y
26	Paper and Allied Products	5.06%			Y
48	Communications	4.77%			Y
25	Furniture and Fixtures	4.75%			
30	Rubber and Plastic Products	4.73%			Y
15	Building Construction, General Contractors	4.51%			Y

The analysis of industries becomes more complex and useful as each variable is added. Table 4 shows that most industries with a high percentage of staffing in OES-2 occupations also offer high wages; in fact, the weekly industrial wage rate is correlated significantly to the percent of staffing within OES-2. However, several industries showing high wages and high technical staffing may not project high absolute change in employment or high percent change in employment. Obviously, ideal candidate industries for this project would show high projected employment growth, high wages, and a high percentage of professional and technical staffing. The next economic competitiveness variable adds an important layer of information.

Capita-to-Labor Ratio

The ratio of capital to labor is the third economic competitiveness factor we apply to the employment growth industries. Firms continuously try to maximize productivity by shifting the mix of labor and technology, plant, equipment, and other capital expenditures. Over time, many industries have opted to substitute capital investment for investment in human resources (labor). This search for greater productivity and increased revenues can have a significant impact on the demand for particular sets of labor skills.

The capital-to-labor ratio for an industry indicates how many dollars are spent on capital (plant, equipment, and technology) for every dollar spent on the purchase of labor (wages and salaries). One might think that an industry with a high capital-to-labor ratio would invest in and value machinery and equipment over labor and would therefore pay its workers low wages. But this is only partially correct. These industries do invest in their capital resources, but their reported average weekly wage rates are also quite high. While industries with a high capital-to-labor ratio invest significantly in capital to be more productive and competitive, they also need very skilled workers to run the machinery and equipment. In fact, an industry's capital-to-labor ratio is correlated significantly to its weekly industrial wage rate. These industries might need fewer workers overall, but the skilled workers employed in these industries earn higher wages compared to workers in other industries.

To compute the ratio, data are collected for new capital expenditures and for gross annual payroll by industry from the most recent U.S. Department of Commerce, Bureau of the Census, Statistical Abstract of the U.S. Divide new capital expenditures by gross annual payroll expenditures. Only industries with a measurable capital-to-labor ratio were included in the analysis. The top half of industries shows a capital-to-labor ratio of more than 0.19 or a median point of 33.5. The top quartile ends at 0.30. Industries included in the top two quartiles are listed in the table below.

Table 5--Top Two Quartiles of Texas Industries Ranked by Capital-to-Labor Ratio

SIC Code	Industry Title	Capital-to-Labor Ratio	Above the State Median of Absolute Change in Projected Employment?	Above the State Median of Percent Change in Projected Employment?	Above the State Median of Average Weekly Wages?	Above the State Median of OES-2 Staffing Pattern?
First Quartile of Industries Ranked by Capital to Labor Ratio						
13	Oil and Gas Extraction	1.63			Y	Y
29	Petroleum Refining and Related Industries	1.45			Y	Y
75	Auto Repair, Services, and Parking	1.29	Y	Y		
46	Pipelines, Ex Natural Gas	1.13			Y	Y
49	Electric, Gas, and Sanitary Services	1.01	Y	Y	Y	Y
10	Metal Mining	0.87			Y	Y
48	Communications	0.76	Y		Y	Y
28	Chemicals and Allied Products	0.59			Y	Y
44	Water Transportation	0.46		Y	Y	
45	Transportation by Air	0.46	Y	Y	Y	Y
26	Paper and Allied Products	0.39			Y	Y
20	Food and Kindred Products	0.38			Y	
53	General Merchandise Stores	0.35	Y			
84	Museums, Art Galleries, and Botanical and Zoological Gardens	0.31		Y		
61	Nondepository Credit Institutions	0.31		Y	Y	Y
70	Hotels, Rooming Houses, Camps, and Other Lodging Places	0.31				
14	Mining and Quarrying of Nonmetallic Minerals, Ex Fuels	0.30			Y	

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SIC Code	Industry Title	Capital-to-Labor Ratio	Above the State Median of Absolute Change in Projected Employment?	Above the State Median of Percent Change in Projected Employment?	Above the State Median of Average Weekly Wages?	Above the State Median of OES-2 Staffing Pattern?
Second Quartile of Industries Ranked by Capital to Labor Ratio						
12	Coal Mining	0.30			Y	Y
37	Transportation Equipment	0.29			Y	Y
60	Depository Institutions	0.25	Y		Y	Y
33	Primary Metal Industries	0.25			Y	Y
36	Electronic and Other Electrical Equipment and Components, Ex Computer Equipment	0.24	Y		Y	Y
32	Stone, Clay, Glass, and Concrete Products	0.24			Y	
65	Real Estate	0.24	Y			
30	Rubber and Plastic Products	0.23			Y	Y
22	Textile Mill Products	0.23	Not Available	Not Available		
79	Amusement and Recreation Services	0.23	Y	Y		
56	Apparel and Accessory Stores	0.22				
41	Local and Suburban Transit and Interurban Highway Passenger Transportation	0.21		Y		
54	Food Stores	0.20	Y	Y		
67	Holding and Other Investment Offices	0.20		Y	Y	Y
24	Lumber and Wood Products, Ex Furniture	0.20				
35	Industrial and Commercial Machinery and Computer Equipment	0.19			Y	Y
78	Motion Pictures	0.19		Y		

What becomes clear from an analysis which combines both employment projections data and job quality/economic competitiveness data is that firms which invest more in technology and capital equipment (high capital-to-labor ratio) also require a skilled workforce (high percent of staffing within OES 2) that can master this technology. These same firms are willing to compensate their skilled workers with high wages (high weekly wage rate). This is especially true for industries such as oil and gas extraction, petroleum refining, coal mining, and electronics manufacturing. On the other hand, these same industries also are laying off long time employees (slower than average or declining employment growth rate) which are no longer necessary with the introduction of new equipment, processes, and technology.

The major exception to this trend is in the Professional Service industries. In these industries, intellectual property is more highly valued than technology. The high levels of professional and technical staff in these knowledge industries account for the relatively low levels of capital investment, while they still earn high wages. The staffing patterns of these industries are dominated by occupations which require baccalaureate degrees or higher.

What remains is to identify those industries which promise both employment growth and economic competitiveness. Industries selected for this project must rank high (above the state median) on either absolute change in projected employment change or percent change in projected employment and rank high (above the state median) in at least two of the three economic competitiveness factors. Table 6 summarizes the findings from tables 1-5.

Table 6--SUMMARY
Texas Industries Showing Employment Growth and Significant Economic Competitiveness

SIC Code	Industry Title	Above the State Median of Absolute Change in Projected Employment?	Above the State Median of Percent Change in Projected Employment?	Above the State Median of Average Weekly Wages?	Above the State Median of OES 2 Staffing Pattern?	Above the State Median of Capital to Labor Ratio?
Industries Above the State Median of All Employment Growth and Economic Competitiveness Variables (2 + 3)						
45	Transportation by Air	Y	Y	Y	Y	Y
49	Electric, Gas, and Sanitary Services	Y	Y	Y	Y	Y
Industries Above the State Median of Either Absolute Change or Percent Change in Employment, and Above the State Median of All Economic Competitiveness Variables (1 + 3)						
36	Electronic and Other Electrical Equipment and Components, Ex Computer Equipment	Y		Y	Y	Y
48	Communication	Y		Y	Y	Y
60	Depository Institutions	Y		Y	Y	Y
61	Nondepository Credit Institutions		Y	Y	Y	Y
67	Holding and Other Investment Offices		Y	Y	Y	Y

SIC Code	Industry Title	Above the State Median of Absolute Change in Projected Employment?	Above the State Median of Percent Change in Projected Employment?	Above the State Median of Average Weekly Wages?	Above the State Median of OES 2 Staffing Pattern?	Above the State Median of Capital to Labor Ratio?
Industries Above the State Median of Each Employment Growth Variables and Above the State Median of Two Economic Competitiveness Variables (2 + 2)						
64	Insurance Agents, Brokers, and Services	Y	Y	Y	Y	
81	Legal Services	Y	Y	Y	Y	
87	Engineering, Accounting, Research, Management, and Related Services	Y	Y	Y	Y	
Industries Above the State Median of Either Absolute Change or Percent Change in Employment, and Above the State Median of Two Economic Competitiveness Variables (1 + 2)						
44	Water Transportation		Y	Y		Y
50	Wholesale Trade, Durable Goods	Y		Y	Y	
89	Misc Services		Y	Y	Y	

The purpose of developing the circular Model of Investigation with filtering variables--presented in Appendix A--was to narrow the Texas SOICC's task to manageable proportions given available resources and time limitations. The Summary Table above focuses on industries which show both employment growth and economic competitiveness because these will offer the best opportunities for the most individuals for high skill, high wage, and high demand jobs. But besides this listing of industries and the emerging and evolving occupations we identify within these industries, this project also lays out a process that will allow researchers to bring forward evidence of other emerging and evolving occupations. Planners, researchers, and labor market analysts can use this process to research industries which show strong employment growth and economic competitiveness at the local level but which may not appear significant at the state level. Through a coordination of state and local research efforts to identify employer needs, adequate resources can be allocated to training and development programs for these targeted industries and occupations.

Circle 3--Filter to Identify Emerging and Evolving Occupations within the Targeted Industries

The first step in this process is to collect nominations for candidate occupations. This project utilized five sources: analyses of employer-submitted payroll titles; mass mailings to representatives from stakeholder groups across the state, including education, workforce development, business, labor, and professional/trade associations; conference workshops; electronic postings and surveys; and reviews of expert and career guidance literature.

Analyses of Employer-Submitted Payroll Titles

The States of Florida and Texas have adopted comprehensive student follow-up systems that rely on the linkage of automated records in various administrative databases.[209] In Florida, the system is operated by the Florida Education and Training Placement Information Program (FETPIP) at the State Department of Education. In Texas, the system is operated by the Automated Student and Adult Learner Follow-up Program at the Texas SOICC. (Florida follow-up data were used as an external validation of the findings from Texas follow-up data.) As part of their operation, both states regularly contact employers for occupational data on former students and program participants. To facilitate transforming employer-provided payroll titles to standard titles, both states have created large job title files. These files are used as thesauri to relate employer payroll and personnel system titles to the Occupational Employment Statistics (OES) classification system. As such they are updated annually with new occupational titles provided by surveyed employers who hired former students/participants. Because the job title files are updated on a regular basis with employer responses, they represent a resource that can be used to identify emerging occupations developed by employers responding to changing workplace requirements.

Job Title Thesaurus Background. Because the number of job title classifications in employer personnel and payroll systems are potentially endless, a job title thesaurus had to be designed. When an employer-provided payroll title is logged through the data entry system, the first search through the job title file is indexed by the employer's industry as indicated by the SIC code obtained earlier through linkages to the Unemployment Insurance wage records. If matches between employer-submitted titles and official OES titles are found, they are recorded for those entries. If no matches are found, second searches are conducted against a sector of horizontal occupations that occur across all industry groups (such as secretaries and bookkeepers). These occupations are grouped as "99" classifications meaning their occurrence is not industry-specific. If a match is found, it is duly recorded. If not, the title is reported as a "pending" title meaning it has to be assigned by research staff to a particular OES classification.

It is important to note that the process of building a job title thesaurus over time does not necessarily mean that each of the occupations that are unrecognized by the system is a unique new job title. Pending files can be created when unrecognizable acronyms, misspellings, or title nuances are provided by employers. Figure 1 is a subset of records from the Florida Job Title File related to the OES title, Registered Nurse.

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[209] Duane Whitfield and Jay Pfeiffer, New and Emerging Occupational Titles: Using Automated Follow-Up Employer Payroll Titles (April 14, 1996.)

Figure 1

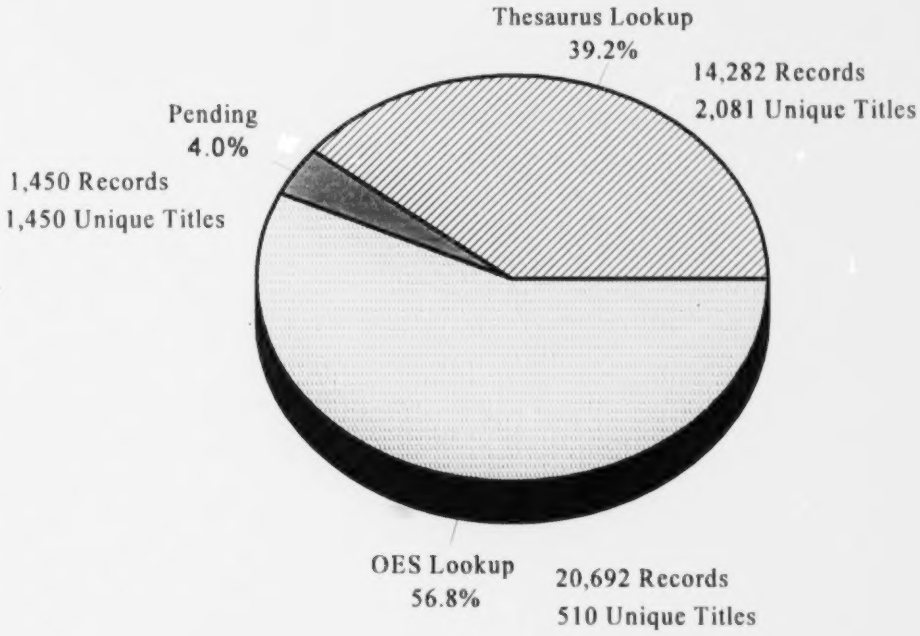
Record Number	Selected Titles Related to Registered Nurses in the Florida Job Title File
1	Administrative Nurse
7	Nurse-General Duty
9	Nurse-Registered
10	Office Nurse
11	RN Nurse
12	RN Midwife
14	RN-Pediatrics
15	Registered Nurse
17	Registered Nurse Practitioner
19	Reg. Nurse
21	Rehabilitation Nurse

The titles listed above are all associated with the OES classification for Registered Nurse. When these titles originally were received from employers most were not resident in the job title apparatus. These therefore were assigned a pending record that had to be associated with an appropriate classification. Note that some of the titles have to be taken in the context of the SIC code of the firm reporting the title. ***The objective in the Emerging and Evolving Occupations Project was to sort through pending titles such as those in Figure 1 to identify titles that could be classified as new or emerging occupations and not just as nuances of existing occupations.***

Methods. The project began with a focus on Florida's follow-up files. Work on the Texas files was added to the scope of the project at a later date. The first step in the process was to download the Florida OES Table Files, Pending History Files, and Job Title Files from the mainframe facilities. The next step was to select a subset of the file's records to work with in the study. The project focused on occupations requiring some degree of postsecondary education and training short of a bachelor's degree. This meant eliminating records in each state's files related to secondary vocational education and four or more years of university-level education. An indicator was built into the master file indicating whether each record was an "OES look-up," a "job title thesaurus look-up," or a "pending record."

Over 36,424 Florida completer records were associated with occupations in one of the three approaches. Approximately 57% of the records (20,692) were represented by 512 of the OES titles resident in the OES table. Approximately 39% (14,282) were represented by 2,081 titles resident in the job title file's thesaurus. The pending occupations--those that matched neither an OES code nor a thesaurus title--represented only 4% of the records (1,450).[210]

OCCUPATIONAL TITLE "LOOKUP" FREQUENCIES



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[210] Researchers noted several instances where staff analysts had misinterpreted the relationships between OES codes and titles and associated payroll titles. They also encountered clues that there might be instances of staff data entry specialists making determinations of relationships while doing the data entry. The former situation suggests a strong need for both states to integrate an annual review process into the development of job title files to assure that relationships are determined accurately. The latter situation must be strongly discouraged. The determination of payroll-to-OES relationships during data entry in effect short-circuits the job title file's development and creates relationships that cannot subsequently be reviewed.

At this point, the researchers felt that the best potential for identifying new and emerging occupations lay with the responses referred to pending status. All pending records for both Texas and Florida were collected. A set of four tables was generated from the Texas and Florida files. The tables list job titles referred to pending status in each state's 1993-94 data collection cycle with the associated industry that provided the response. There are two Florida tables and two Texas tables--one is sorted by frequency and one is alphabetical. ***These tables constitute the principal findings from the follow-up analysis and are included in Appendix D. The pending titles listed in these tables are suspect titles for emerging occupations.*** Excerpts from the tables are provided below.

Recommendations and Findings. The pending record referral process from the automated follow-up system has the most promise as an indicator of new and emerging occupations. The listings reflected in Figures 2 and 3 should be interpreted as clues that could indicate a new or emerging occupational opportunity. Figure 2 is an excerpt from the alphabetical listing of pending payroll titles that were reported to the FETPIP system. Figure 3 is an excerpt from the alphabetical listing of pending payroll titles reported to the Texas automated system.

Figure 2

Pending Job Title	Count	SIC	Industry
Cellular Phone Installer	1	59	Misc Retail
Computer Graphics	1	73	Business Services
Computer Network Supporter	1	80	Health Services
Computer Software Installer	1	73	Business Services
Data Analyst Specialist	1	76	Misc Repair Services
Data Base Administrator	1	27	Printing & Publishing

Figure 3

Pending Job Title	Count	SIC	Industry
Alarm Installer Technician	1	17	Special Trade Contractors
Application Developer	1	50	Wholesale Trade/durable Goods
Applications Programmer	1	49	Electric Gas & Sanitary Services
Auto Cad Technician	1	87	Engineering & Management Services
Bilingual Telephone Representative	2	73	Business Services

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With minor changes made next year to the follow-up data entry and analysis system, the pending files can be useful indicators of occupational change and serve as an automated bridge from targeted industries to occupations. The following are recommended modifications to the Texas Automated Student and Adult Learner Follow-Up System, to aide in the identification of new and emerging occupations:

- All data entry associated with the handling of employer responses should be directed to record replies in the form they are provided - without interpretation by data entry staff.
- The pending/occupational thesaurus processes in each state should be changed to do two things. First the number of times per year that a particular title/SIC relationship is accessed in the occupational thesaurus to resolve a response should be recorded in the systems. Secondly, the time period during which a pending record is received from an employer should be recorded (or lookup files with "counters" saved annually).
- As Texas restructures its employer contact processes, it should consider including the capacity to identify how each response was handled as well as accommodating the counting and dating conventions suggested in Recommendation 2. It should also include mechanisms to retain the relationship between a response and the vocational program classification that related to it.
- Efforts should be made to obtain standard job classification systems that are increasingly appearing among employers (for example the Workers' Compensation classification system). These should be incorporated into the occupational thesaurus apparatus. With as many "standard" titles incorporated as possible, the sensitivity of the pending referral process to new and emerging situations will be enhanced.
- Efforts undertaken in each state to verify the correctness of employer responses should include an effort to request additional information on occupations thought to be new or emerging.
- The OES taxonomy is about to be expanded from about 750 titles to about 1200+ titles. This is in conjunction with the national O*Net initiative. Occupational Thesaurus and OES Tables that constitute the employer contact apparati in each state should be restructured to include this new taxonomy as soon as possible.
- Each state should consider fostering the development of a consensus-building process charged with a responsibility to reach agreement on establishing new training to address new and emerging employment opportunities. As a part of this process,

projections from the OES program could be considered along with occupationally-specific placement data and the "clues" available from pending records. Lists containing these clues could be used as a tool to foster collaboration between economic development, workforce development, and employer organizations regarding the need to structure new training programs.

Mass Mailings to Stakeholder Groups

Besides analysis of follow-up data, a second approach for collecting occupational nominations consisted of mass mailings to potential stakeholder groups across the state. The bulk mailout packet included an introductory letter about the project and a request for feedback about the project and nominations for candidate emerging and evolving occupations. Addressees were encouraged to circulate the information as appropriate, and were provided the Texas SOICC homepage address and the Project Director's e-mail address. A total of 2,200 letters were sent during the first quarter of the project. Distribution for the mailout included groups representing: Secondary Education Service Centers--Public Education Information Management System Coordinators; Secondary Education Service Centers--Vocational Education Coordinators; Tech Prep Consortia; Postsecondary Education Vocational Deans; Postsecondary Education Institutional Researchers; College Placement Officers; Pilot One-Stop Career Centers; Workforce Development Boards; Quality Work Force Planning Committees; Job Training Partnership Act Substate Areas and Service Delivery Areas; the Center for Occupational Research and Development; the American Training Standards Institute; the Texas Employment Commission's Job Service Employer Committee Employers; the AFL-CIO; the United Auto Workers; Teamsters; Texas Chamber of Commerce Executives; and the Texas Chapters of Professional Associations representing Agriculture, Apparel, Aviation, Business, Conservation/ Environment, Demographics/Economics, Education, Electronics/Data Processing/Engineering, Employees/Employment, Energy, Executives, Exporters, Food, Gas, Health Care, Industry, Manufacturing, Medicine, Recycling, Research, Safety, and Textiles.

Conference Workshops

A third approach for marketing the project and collecting occupational nominations involved the delivery of presentations about the project at conferences, workshops, and meetings with potential stakeholder groups. Presentation and workshop sessions included the *Career and Technology Conference* sponsored by the Texas Education Agency in Austin on July 18 and 19, 1995; the *12th Annual Work Now and in the Future* conference sponsored by the Northwest Regional Education Laboratory in Portland, Oregon on November 6, 1995; the *1995 Annual Texas SOICC Conference* sponsored by the Texas SOICC in Austin on November 28, 1995; a Departmental Chairs meeting with Texas State Technical College staff and faculty in Waco on December 6, 1995; the *3rd Annual State Tech Prep Conference* in Austin on March 28, 1996; the *Texas Business and Education Coalition Conference* in Houston on April 2, 1996; and the *Texas Careers Centers Conference* sponsored by the Texas Workforce Commission in Dallas on May 29, 1996. Over 100 copies of handout packets were distributed at most conference sessions, totaling approximately 700 packets. Through the course of the year, over 40 project marketing packets were mailed in response to requests for additional information.

Electronic Postings and Surveys
A fourth approach for marketing the project, disseminating information, collecting occupational nominations, and maintaining an electronic dialogue with all interested parties involved the development and maintenance of an Internet web site. Early in the first quarter of the project (July-August, 1995) six pages of text were uploaded to the Texas SOICC homepage at <http://www.soicc.capnet.state.tx.us>. These web pages summarized the project methodology and sought nominations for candidate emerging and evolving occupations and related job descriptions. To facilitate feedback and communication, each web page provided an electronic "hot button" link to the Project Director's e-mail address. Over 86 electronic messages were received about the project.

In March, 1996 eight tables of 418 compiled occupational nominations were uploaded to this website. Field experts and other interested parties were asked to validate the nominations and provide descriptive or employment demand information about any title or titles with which they were familiar, or to provide a contact resource for the title/titles. The various submission sources included Texas field professionals; Texas Job Training Partnership Act Substate Area/Service Delivery Area targeted occupations lists; Texas student follow-up data; Florida student follow-up data; the federal Bureau of Labor Statistics; and career guidance literature sources. In addition to the "hot button" link to the Project Director's e-mail address, this latest Internet posting included a formatted page of questions that could be printed, completed, and faxed to the Texas SOICC office.

Reviews of Expert and Career Guidance Literature
The final method for collecting information about the targeted industries and candidates for emerging and evolving occupations within these industries included extensive literature reviews. The two main sources of literature included career guidance information and industry-specific information; specific titles are listed in the bibliography of this report. Career guidance information sources ranged from federal documents developed by the Department of Labor to publications from futurists, educators, economists, and other experts in the workforce development and employment fields. These documents provided various perspectives on the current and predicted states of the workforce. Knowing what the trends are in terms of work and employment in the future is very helpful in making career and training choices today. This information provides an important context within which to make informed career decisions.

Industry expert literature included the U.S. Department of Commerce Industrial Outlook and Standard and Poor's Industry Surveys. These sources provide the most comprehensive overviews of major U.S. industries and the technological and consumer demand trends affecting them. To provide more detail in some areas and to fill in gaps, documents were collected from newspapers, trade journals, and business and economic analysis papers. Over 300 books and periodicals were reviewed. After the thirteen targeted industries and key emerging/evolving occupations were identified, approximately 56 professional and trade associations in the targeted industries were contacted to validate the findings and gather detailed information about occupational skills and competencies. Information collected from these sources together created a detailed picture of each of the targeted industries and the major trends affecting them. By synthesizing the information from these industry sources, the career guidance sources, and the nominations compiled from field and industry experts, research staff were able to isolate 42 occupational clusters and specific occupational titles related to the thirteen targeted industries.

Conclusion

After the list of candidate emerging and evolving occupations is completed, the Project Methodology calls for the application of further criteria to be added to the occupational candidates. These criteria are appropriate to the narrower mission, goals, and objectives of the key customers of this project. The criteria include a standard occupational training time of two years or less; occupational wages high enough to provide economic self-sufficiency, and a high number of potential employment opportunities statewide. (If the list of candidate occupations is too lengthy to be covered with available resources, the list may need to be further narrowed according to Filer 4.) Emerging and evolving occupations meeting these criteria offer the best employment opportunities for youth and adult clients of the workforce development partner agencies.

APPENDIX C:
COMPLETE INDUSTRY ANALYSIS LISTING ARRANGED BY STANDARD INDUSTRIAL CLASSIFICATION (SIC) CODE

Texas Industries Ranked by SIC Code
Y = above state median of variable *X*
N = below state median of variable *X*
NA=data not available

SIC Code	Industry Title	Above the State Median of Absolute Change in Projected Employment	Above the State Median of Percent Change in Projected Employment	Above the State Median of Average Weekly Wages	Above the State Median of OES 2 Staffing Pattern	Above the State Median of Capital to Labor Ratio
	Agriculture, Forestry, and Fishing					
01	Agricultural Production, Crops	N	N	N	N	NA
02	Agriculture Production, Livestock and Animal Specialities	NA	NA	N	NA	NA
07	Agricultural Services	N	Y	N	N	N
08	Forestry	N	Y	NA	Y	NA
09	Fishing, Hunting, and Trapping	N	Y	NA	N	NA
	Mining					
10	Metal Mining	N	N	Y	Y	Y
12	Coal Mining	N	N	Y	Y	Y
13	Oil and Gas Extraction	N	N	Y	Y	Y
14	Mining and Quarrying of Nonmetallic Minerals, Ex Fuels	N	N	Y	N	Y
	Construction					
15	Building Construction, General Contractors	N	N	Y	Y	N
16	Heavy Construction Ex Building Construction	N	N	Y	Y	N
17	Construction, Special Trade Contractors	Y	Y	N	N	N

SIC Code	Industry Title	Above the State Median of Absolute Change in Projected Employment	Above the State Median of Percent Change in Projected Employment	Above the State Median of Average Weekly Wages	Above the State Median of OES 2 Staffing Pattern	Above the State Median of Capital to Labor Ratio
	Manufacturing					
20	Food and Kindred Products	N	N	Y	N	Y
21	Tobacco Products	N	N	NA	NA	NA
22	Textile Mill Products	NA	NA	N	N	Y
23	Apparel and Other Finished Products Made from Fabrics	N	N	N	N	N
24	Lumber and Wood Products, Ex Furniture	N	N	N	N	Y
25	Furniture and Fixtures	N	N	N	Y	N
26	Paper and Allied Products	N	N	Y	Y	Y
27	Printing, Publishing, and Allied Industries	N	N	Y	N	N
28	Chemicals and Allied Products	N	N	Y	Y	Y
29	Petroleum Refining and Related Industries	N	N	Y	Y	Y
30	Rubber and Misc Plastics Products	N	N	Y	Y	Y
31	Leather and Leather Products	N	N	N	N	N
32	Stone, Clay, Glass, and Concrete Products	N	N	Y	N	Y
33	Primary Metal Industries	N	N	Y	Y	Y
34	Fabricated Metal Products, Ex Machinery and Transportation Equipment	N	N	Y	Y	N
35	Industrial and Commercial Machinery and Computer Equipment	N	N	Y	Y	Y
36	Electronic and Other Electrical Equipment and Components, Ex Computer Equipment	Y	N	Y	Y	Y
37	Transportation Equipment	N	N	Y	Y	Y
38	Measuring, Analyzing, and Controlling Instruments; Photographic, Medical, and Optical Goods; Watches and Clocks	N	N	Y	Y	N

SIC Code	Industry Title	Above the State Median of Absolute Change in Projected Employment	Above the State Median of Percent Change in Projected Employment	Above the State Median of Average Weekly Wages	Above the State Median of OES 2 Staffing Pattern	Above the State Median of Capital to Labor Ratio
39	Misc Manufacturing Industries	N	N	N	N	N
	Transportation, Communications, Electric, Gas, and Sanitary Services					
40	Railroad Transportation	N	N	N	N	NA
41	Local and Suburban Transit and Interurban Highway Passenger Transportation	N	Y	N	N	Y
42	Motor Freight Transportation and Warehousing	Y	N	N	N	N
43	United States Postal Service	N	N	NA	N	NA
44	Water Transportation	N	Y	Y	N	Y
45	Transportation by Air	Y	Y	Y	Y	Y
46	Pipelines, Ex Natural Gas	N	N	Y	Y	Y
47	Transportation Services	Y	Y	N	N	N
48	Communication	Y	N	Y	Y	Y
49	Electric, Gas, and Sanitary Services	Y	Y	Y	Y	Y
	Wholesale Trade					
50	Wholesale Trade, Durable Goods	Y	N	Y	Y	N
51	Wholesale Trade, Nondurable Goods	Y	N	Y	N	N
	Retail Trade					
52	Building Materials, Hardware, Garden Supply, and Mobile Home Dealers	Y	Y	N	N	N
53	General Merchandise Stores	Y	N	N	N	Y
54	Food Stores	Y	Y	N	N	Y
55	Automotive Dealers and Gasoline Service Stations	N	N	N	N	N
56	Apparel and Accessory Stores	N	N	N	N	Y
57	Home Furniture, Furnishings, and Equipment Stores	Y	Y	N	N	N
58	Eating and Drinking Places	Y	Y	N	N	N
59	Misc Retail	N	N	N	N	N

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SIC Code	Industry Title	Above the State Median of Absolute Change in Projected Employment	Above the State Median of Percent Change in Projected Employment	Above the State Median of Average Weekly Wages	Above the State Median of OES 2 Staffing Pattern	Above the State Median of Capital to Labor Ratio
	Finance, Insurance, and Real Estate					
60	Depository Institutions	Y	N	Y	Y	Y
61	Nondepository Credit Institutions	N	Y	Y	Y	Y
62	Security and Commodity Brokers, Dealers, Exchanges, and Services	N	Y	NA	Y	N
63	Insurance Carriers	N	N	Y	Y	N
64	Insurance Agents, Brokers, and Services	Y	Y	Y	Y	N
65	Real Estate	Y	N	N	N	Y
67	Holding and Other Investment Offices	N	Y	Y	Y	Y
	Services					
70	Hotels, Rooming Houses, Camps, and Other Lodging Places	N	N	N	N	Y
72	Personal Services	Y	Y	N	N	N
73	Business Services	Y	Y	N	Y	N
75	Automotive Repair, Services, and Parking	Y	Y	N	N	Y
76	Misc Repair Services	N	Y	N	N	N
78	Motion Pictures	N	Y	N	N	Y
79	Amusement and Recreation Services	Y	Y	N	N	Y
80	Health Services	Y	Y	N	N	N
81	Legal Services	Y	Y	Y	Y	N
82	Educational Services	Y	Y	N	N	N
83	Social Services	Y	Y	N	Y	N
84	Museums, Art Galleries, and Botanical and Zoological Gardens	N	Y	N	N	Y
86	Membership Organizations	Y	N	N	Y	N
87	Engineering, Accounting, Research, Management, and Related Services	Y	Y	Y	Y	N
88	Private Households	Y	N	NA	Y	NA

SIC Code	**Industry Title**	**Above the State Median of Absolute Change in Projected Employment**	**Above the State Median of Percent Change in Projected Employment**	**Above the State Median of Average Weekly Wages**	**Above the State Median of OES 2 Staffing Pattern**	**Above the State Median of Capital to Labor Ratio**
89	Misc Services	N	Y	Y	Y	N
	Public Administration					
92	Justice, Public Order, and Safety	Y	N	N	Y	NA
93	Public Finance, Taxation, and Monetary Policy	Y	N	N	Y	NA

APPENDIX D:
DETAILED RESULTS FROM ANALYSES OF TEXAS AND FLORIDA FOLLOW-UP

Pending Job Titles Submitted by Florida Industries Listed Alphabetically[211]

FLORIDA PENDING JOB TITLE	COUNT	SIC	INDUSTRY
Addictions Tech	2	80	Health Services
Aids Educator	2	86	Membership Organizations
Angio Assembler	1	38	Instruments & Related Products
Aquatic Plant Technician	1	95	Environmental Quality & Housing
Auto Cad	3	50	Wholesale Trade/ Durable Goods
Autopsy Technician	1	80	Health Services
Avian Technician	1	59	Misc Retail
Boot Camp Drill Instructor	3	92	Justice Public Order & Safety
Cellular Phone Installer	1	59	Misc Retail
Coder/ Analyst Medical Records	1	80	Health Services
Computer Graphics	1	73	Business Services
Computer Information Specialist	1	86	Membership Organizations
Computer Network Supporter	1	80	Health Services
Computer Operations Clerk	1	91	Executive Legislative & General
Computer Software Installer	1	73	Business Services
Computer Support Tech	1	82	Educational Services
Control	1	30	Rubber & Misc Plastics Products
Costumer ii	1	79	Amusement & Recreation Services
Cv Technician	1	80	Health Services
Data Analyst Specialist	1	76	Misc Repair Services
Data Base Administrator	1	27	Printing & Publishing
Data Processing Team Leader	1	80	Health Services
Data Systems Coordinator	1	80	Health Services
Donor Room Tech	1	80	Health Services

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[211] Pending titles located by the Texas and Florida Follow-Up Systems are merely **suspect** titles for emerging and evolving occupations.

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FLORIDA PENDING JOB TITLE	COUNT	SIC	INDUSTRY
Donor Services Technician	2	80	Health Services
Drill Instructor	2	83	Social Services
Echo Tech	2	80	Health Services
Echocard Tech	1	80	Health Services
Electronic Court Reporter	1	91	Executive Legislative & General
Environmental Officer	1	91	Executive Legislative & General
Environmental Safety Director	1	75	Auto Repair Services & Garages
Environmental Tech	2	91	Executive Legislative & General
Fitness Consultant	1	79	Amusement & Recreation Services
Fitness Tech	1	79	Amusement & Recreation Services
Gis Cadastralist	1	93	Finance Taxation & Monetary Policy
Gis Technician	1	91	Executive Legislative & General
Hair Replacement Technician	1	72	Personal Services
Haz-Mat Technician	1	17	Special Trade Contractors
HME Technician	3	80	Health Services
Home School Liaison	2	82	Educational Services
Homecare LPN II	3	80	Health Services
Immunization Coordinator	1	82	Educational Services
Information Services Clerk	1	82	Educational Services
Information Systems Clerk	1	91	Executive Legislative & General
Investigators Specialist	3	73	Business Services
Material Fuser	1	23	Apparel & Other Textile Products
Noise Abatement Technician	1	45	Transportation by Air
Noise Technician	1	91	Executive Legislative & General
Older Worker Specialist	1	83	Social Services
PC Support Specialist	1	60	Banking
PC Technician	1	80	Health Services
Psych Specialty Technician	1	80	Health Services
Psychology Technician	1	80	Health Services
Quality Analyst	1	38	Instruments & Related Products
Quality Assurance Reviewer	2	83	Social Services

FLORIDA PENDING JOB TITLE	COUNT	SIC	INDUSTRY
Quality Assurance Supervisor	1	73	Business Services
Quality Auditor II	1	36	Electric & Electronic Equipment
Quality Control Operator	1	87	Engineering & Management Services
Quality Imp Analyst	1	80	Health Services
Quality Technician III	1	38	Instruments & Related Products
Simulator Instructor	1	82	Educational Services
Sound & Communication Tech	1	82	Educational Services
Spec Imaging Technologist	1	80	Health Services
Special Procedure Technologist	1	80	Health Services
Special Procedures Tech	1	80	Health Services
Spraycrete Technician	1	17	Special Trade Contractors
Structural Claimworker	1	15	General Building Contractors
Support Associate	5	60	Banking
Tele Researcher	2	51	Wholesale Trade/ Nondurable Goods
Temp CADD Draftsman	1	80	Health Services
Trained Consumer	2	87	Engineering & Management Services
Uniform Monogrammer	2	56	Apparel & Accessory Stores
Videotape Operator	1	48	Communications

Pending Job Titles Submitted by Texas Industries Listed Alphabetically

TEXAS PENDING JOB TITLE	COUNT	SIC	INDUSTRY
Adaptive Technician Asst	1	94	Administration of Human Resources
Advanced Practitioner	4	80	Health Services
After School Care Worker	2	86	Membership Organizations
Alarm Installer Tech	1	17	Special Trade Contractors
Anl Qual Admin	1	37	Transportation Equipment
Anl Sprs Reqd Ld	1	37	Transportation Equipment
Application Developer	1	50	Wholesale Trade/ Durable Goods
Application Support	1	61	Credit Agencies Other Than Banks
Applications Programmer	1	49	Electric Gas & Sanitary Services
Applications Programmer	1	64	Insurance Agents Brokers & Service
Assoc Eng Gp Plnr	1	37	Transportation Equipment
Auto CAD Operator	4	87	Engineering & Management Services
Auto CAD Operator	1	24	Lumber & Wood Products
Auto CAD Operator	1	35	Machinery Except Electrical
Auto CADD Technician	1	87	Engineering & Management Services
Auto CAD Designer	2	73	Business Services
Auto CAD Drafting	1	38	Instruments & Related Products
Auto CAD Draftsman	1	87	Engineering & Management Services
Banbury Operator	1	30	Rubber & Misc Plastics Products
Bare Mill Dept/ Dept Serv	1	33	Primary Metal Industries
Berber Bundler	1	23	Apparel & Other Textile Products
Bilingual Telephone Rep	2	73	Business Services
Bio Asst Analyst	1	87	Engineering & Management Services
Bronchogenic Screen Clini	1	80	Health Services
C-Ray Technician	1	80	Health Services
CAD Design Drafter	1	73	Business Services
CAD Designer Draftsman	1	87	Engineering & Management Services
CAD Drafter	5	73	Business Services
CAD Drafter	4	87	Engineering & Management Services
CAD Drafter	1	34	Fabricated Metal Products

TEXAS PENDING JOB TITLE	COUNT	SIC	INDUSTRY
CAD Drafter I	1	73	Business Services
CAD Draftsman	4	87	Engineering & Management Services
CAD Draftsman	1	17	Special Trade Contractors
CAD Draftsman	1	35	Machinery Except Electrical
CAD Draftsman	1	50	Wholesale Trade/ Durable Goods
CAD Draftsman	1	73	Business Services
CAD Equip Spec	1	49	Electric Gas & Sanitary Services
CAD Manager	1	35	Machinery Except Electrical
CAD Oper/ Designer	1	36	Electric & Electronic Equipment
CAD Oper/ Material Receiv	1	50	Wholesale Trade/ Durable Goods
CAD Operator Drafter	1	38	Instruments & Related Products
CAD Operator /Draftsman	1	87	Engineering & Management Services
CAD Specialist/ Draftsman	1	87	Engineering & Management Services
CADD Drafter	5	87	Engineering & Management Services
CADD Draftsman	1	87	Engineering & Management Services
Cardiopulmonary Tech I	1	80	Health Services
Caser Tong Operator	1	13	Oil & Gas Extraction
CE Instructor	3	82	Educational Services
Cellular Coordinator	1	48	Communications
Cellular Technician	1	48	Communications
Cert Home Health Aide	1	73	Business Services
Certified Medication Aide	4	80	Health Services
Circuit Board Designer	1	50	Wholesale Trade/ Durable Goods
Circuit Card Tester	1	35	Machinery Except Electrical
Clerk/ Veni	1	80	Health Services
CME Technician	1	87	Engineering & Management Services
Coder/ Analyst	1	80	Health Services
Coder/ Insur Clk/ Dr Asst	1	80	Health Services
Coding Specialist	8	80	Health Services
Coding Technician I	5	80	Health Services
Community Counselor	2	83	Social Services

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TEXAS PENDING JOB TITLE	COUNT	SIC	INDUSTRY
Computer Aided Drafting	1	87	Engineering & Management Services
Computer Aided Draftsman	1	49	Electric Gas & Sanitary Services
Computer Embroidery Machi	1	56	Apparel & Accessory Stores
Computer Network Tech	3	82	Educational Services
Computer Network Tech	1	48	Communications
Computer Stitch Operator	1	31	Leather & Leather Products
Computer Tomograph Techno	1	80	Health Services
Computer/ CAD	1	50	Wholesale Trade/ Durable Goods
Converting Line Operator	2	26	Paper & Allied Products
CSD Network Engineer	1	50	Wholesale Trade/ Durable Goods
CSD Technician	3	50	Wholesale Trade/ Durable Goods
CT Scan Technologist	1	80	Health Services
CT Scans/ Nuclear Med/ X-Ray	1	80	Health Services
Data Acquisit/ Verif Tech	2	73	Business Services
Data Analysis Clerk	2	80	Health Services
Data Integrity Analyst	1	80	Health Services
Decontamination Tech	1	87	Engineering & Management Services
Dimension Mill Operations	1	25	Furniture & Fixtures
Design Draftsman/ CAD	1	35	Machinery Except Electrical
Designer Drafter	1	38	Instruments & Related Products
Designer/ Mgr CAD Operation	1	87	Engineering & Management Services
Diagnostic Imaging Spec	4	80	Health Services
Diagnostic Imaging Tech	1	80	Health Services
Donor Procurement Tech II	2	80	Health Services
Drafter Auto CAD	1	87	Engineering & Management Services
Drafter/ CAD Operator	1	87	Engineering & Management Services
Draftsman/ CADD Operator	1	87	Engineering & Management Services
Draftsman/ Computer	1	35	Machinery Except Electrical
DRG Coder	4	80	Health Services
DS QI Coordinator	1	80	Health Services
Educ Support Serv Tech II	2	82	Educational Services

TEXAS PENDING JOB TITLE	COUNT	SIC	INDUSTRY
Electrical CAD Technician	1	87	Engineering & Management Services
Electromechanical CAD Tech	1	87	Engineering & Management Services
Embroidery Machine Oper	1	23	Apparel & Other Textile Products
Enviromental Coordinator	1	51	Wholesale Trade/ Nondurable Goods
Enviromental Specialist	1	49	Electric Gas & Sanitary Services
Environ Tech Instructor	1	82	Educational Services
Environmental Clerk	1	28	Chemicals & Allied Products
Environmental Operator	1	42	Trucking & Warehousing
Environmental Qual Inspec	1	91	Executive Legislative & General
Environmental Qual Spec	1	16	Heavy Construction Contractors
Environmental/ Safety Tech	1	13	Oil & Gas Extraction
Fiber Forming Oper Winder	2	32	Stone Clay & Glass Products
Field Paramedic	1	41	Local & Interurban Passenger Transit
Gift Consultant	6	59	Misc Retail
Global Representative I	1	60	Banking
Glost Utility	1	32	Stone Clay & Glass Products
Habilitation Attendant	1	80	Health Services
Habilitation Trainer	1	80	Health Services
Habilitator/ Homemaker	1	83	Social Services
Haz Material Techn	2	16	Heavy Construction Contractors
Help Desk Specialist I	2	82	Educational Services
Home Care RN	3	80	Health Services
Home Health Attendant	2	83	Social Services
Home Health Field Nurse	1	80	Health Services
Home Health LVN	6	80	Health Services
Home Health Nurse	3	80	Health Services
Home Health Supervisor RN	3	80	Health Services
Homebase Education/ Coord	1	83	Social Services
Hospice Home Care Nurse	2	80	Health Services
Hospice Nurse	3	80	Health Services
Hospice RN	3	80	Health Services

TEXAS PENDING JOB TITLE	COUNT	SIC	INDUSTRY
I/E Drafter	3	87	Engineering & Management Services
I/E Mechanic	2	28	Chemicals & Allied Products
I/E Technician	6	33	Primary Metal Industries
I/E Technician	4	28	Chemicals & Allied Products
I/E Trainee	2	28	Chemicals & Allied Products
Information/ Control Tech	4	49	Electric Gas & Sanitary Services
Instrument Control Tech	4	49	Electric Gas & Sanitary Services
Instrument Tech Apprent	3	17	Special Trade Contractors
Instrument/ Control Tech	3	49	Electric Gas & Sanitary Services
Instrument/ Elect Dept	3	87	Engineering & Management Services
Instrumentation Helper	3	17	Special Trade Contractors
Intergraph Drafter	2	73	Business Services
Interperter I	3	82	Educational Services
Interpreter for the Deaf	1	82	Educational Services
Interpreter I	2	82	Educational Services
Interpreter/ Note Taker	1	82	Educational Services
Interpreter/ Notetaker	1	82	Educational Services
Interpreter/ Tour Guide	1	86	Membership Organizations
Junior CAD Operator	1	13	Oil & Gas Extraction
KPS Associate	3	72	Personal Services
Laser Technician II	3	38	Instruments & Related Products
Learning Resources Asst	5	82	Educational Services
Legal Technician	3	73	Business Services
LPTA I	4	80	Health Services
Lube Center Technician	2	75	Auto Repair Services & Garages
LVN Apheresis Nurse	1	80	Health Services
LVN Field Nurse	4	80	Health Services
LVN Home Health	2	80	Health Services
LVN Home Health Nurse	2	80	Health Services
LVN/ Field Nurse	1	80	Health Services
Magn Resonance Image Tech	1	80	Health Services

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TEXAS PENDING JOB TITLE	COUNT	SIC	INDUSTRY
Magnetic Resonance Imagin	1	82	Educational Services
Med Imag Rad Technologist	1	80	Health Services
Medical Eligibles Spec	2	83	Social Services
Medical Service Consult	2	64	Insurance Agents Brokers & Service
Medication Aide	2	80	Health Services
MH Case Manager	1	83	Social Services
MH/MR	1	83	Social Services
MHMR Aide	7	80	Health Services
MHMR Aide	7	83	Social Services
MHMR Serv Assistant	2	83	Social Services
Mhmr Serv Asst	1	83	Social Services
MHMR Serv Asst/ Workshop	1	83	Social Services
MHMR Service Assistant	5	83	Social Services
MHMR Service Assistant	4	80	Health Services
MHMR Service Asst	2	83	Social Services
MHMR Service Asst/ Tech	1	83	Social Services
MHMR Services Assistant	13	83	Social Services
MHMR Services Assistant	8	80	Health Services
MHMR Services Asst	2	80	Health Services
MHMR Services Asst	1	83	Social Services
MHMR Spec I	2	83	Social Services
MHMR Spec II	5	83	Social Services
MHMR Specialist	6	83	Social Services
MHMR Specialist	1	80	Health Services
MHMR Specialist Asst	1	80	Health Services
MHMR Specialist I	1	80	Health Services
MHMR Specialist I	1	83	Social Services
MHMR Supervisor	2	83	Social Services
MHMR Supervisor	1	80	Health Services
Micro Computer User Spec	2	82	Educational Services
Modular LVN Charge	8	80	Health Services

TEXAS PENDING JOB TITLE	COUNT	SIC	INDUSTRY
MRI Associate	2	80	Health Services
NC Machine Operator	1	35	Machinery Except Electrical
NC Milling Mach Oper sr	1	37	Transportation Equipment
NC Operator	1	76	Misc Repair Services
NCC Controller	1	48	Communications
NDE Technician	4	87	Engineering & Management Services
Network Analyst	1	35	Machinery Except Electrical
Network Cable Puller	1	50	Wholesale Trade/ Durable Goods
Network Distrib Serv Mgr	3	48	Communications
Network Engineer	1	17	Special Trade Contractors
Network Engineering Mgr	2	48	Communications
Network Quality Analyst	1	63	Insurance Carriers
Network Services Tech I	1	60	Banking
Network Support Spec	1	94	Administration of Human Resources
Network Support Special	1	82	Educational Services
Network Technician	1	80	Health Services
Network Technician	1	87	Engineering & Management Services
Network Technician Engin	1	48	Communications
Network/ Training Spec	2	82	Educational Services
Nuclear Med Technologist	2	80	Health Services
Nuclear Medicine Technol	2	80	Health Services
Nuclear Medicine Technolo	5	82	Educational Services
Oven Room Technician	2	87	Engineering & Management Services
PC/ LAN Administrator	1	73	Business Services
PC/ LAN Administrator	1	79	Amusement & Recreation Services
Phone Center Counselor	3	80	Health Services
Phone Interviewer	1	87	Engineering & Management Services
Phoner/ Political Polls	2	73	Business Services
Pre Board Screener	6	73	Business Services
Primary Home Care Supv	9	80	Health Services
Process Control Spec	1	26	Paper & Allied Products

TEXAS PENDING JOB TITLE	COUNT	SIC	INDUSTRY
Process Tech Trainee	8	28	Chemicals & Allied Products
Process Validation Tech	1	38	Instruments & Related Products
Product Control Leader	1	13	Oil & Gas Extraction
Product Qual Assur Tech	1	35	Machinery Except Electrical
Product Quality Manager	1	23	Apparel & Other Textile Products
Product Release Supv	1	37	Transportation Equipment
Prosthetic/ Orthotic Tech	1	80	Health Services
Provider Home Health Care	1	80	Health Services
Qual Assur/ Mail/ Shipping	1	80	Health Services
Qual Assurance/ Warehouse	1	73	Business Services
Qual Control Assure Tech	1	80	Health Services
Quality Assur Inspector	2	50	Wholesale Trade/ Durable Goods
Quality Assur Nurse Coor	1	80	Health Services
Quality Assurance Coord	1	50	Wholesale Trade/ Durable Goods
Quality Assurance Inspect	1	33	Primary Metal Industries
Quality Assurance Rep	1	63	Insurance Carriers
Quality Assurance Review	1	63	Insurance Carriers
Quality Assurance RN	1	80	Health Services
Quality Assurance Spec	1	28	Chemicals & Allied Products
Quality Control Dept	1	61	Credit Agencies Other than Banks
Quality Control Inspect	1	38	Instruments & Related Products
Quality Control Person	1	20	Food & Kindred Products
Quality Control Proc Tech	1	33	Primary Metal Industries
Quality Control Super	1	23	Apparel & Other Textile Products
Quality Control Super	1	35	Machinery Except Electrical
Quality Control Superviso	1	26	Paper & Allied Products
Quality Control Superviso	1	30	Rubber & Misc Plastics Products
Quality Control Superviso	1	37	Transportation Equipment
Quality Control Worker	1	20	Food & Kindred Products
Quality Control/ Motor Sho	1	37	Transportation Equipment
Quality Control/ Parts Ins	1	37	Transportation Equipment

TEXAS PENDING JOB TITLE	COUNT	SIC	INDUSTRY
Quality Coordinator	2	29	Petroleum & Coal Products
Quality Inspector B	1	37	Transportation Equipment
Quality Production Oper	2	38	Instruments & Related Products
Quality Supervisor	1	50	Wholesale Trade/ Durable Goods
RN Primary Home Care Supe	1	80	Health Services
RN/ Branch Mgr Home Care	1	80	Health Services
RN/ Field Nurse	1	80	Health Services
RN/ Field Staff	1	73	Business Services
Rn/ Home Health	1	73	Business Services
Rn/ Home Health Aide Coord	1	80	Health Services
Security Install Tech	2	17	Special Trade Contractors
Seismic Crew Member	1	65	Real Estate
Specialist MHMR	1	83	Social Services
Sr Quality Assurance Asst	1	28	Chemicals & Allied Products
Studio Phone Sales	11	72	Personal Services
System Support Specialist	2	92	Justice Public Order & Safety
Systems Clerk	2	54	Food Stores
Systems Support Spec	2	83	Social Services
Systems Support Spec II	2	16	Heavy Construction Contractors
Tech - Rt	2	80	Health Services
Technical Staff Assistant	3	82	Educational Services
Telephone Advocate	2	83	Social Services
Telephone Communicator	2	72	Personal Services
Vet Tech	3	07	Agricultural Services
Vet Technician	5	07	Agricultural Services
Wafer Fab Operations Tech	3	36	Electric & Electronic Equipment

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Pending Job Titles Submitted by Florida Industries Listed by Frequency

FLORIDA PENDING JOB TITLE	COUNT	SIC	INDUSTRY
Support Associate	5	60	Banking
Auto CAD	3	50	Wholesale Trade/ Durable Goods
Boot Camp Drill Instructor	3	92	Justice Public Order & Safety
HME Technician	3	80	Health Services
Homecare LPN II	3	80	Health Services
Investigators Specialist	3	73	Business Services
Addictions Tech	2	80	Health Services
Aids Educator	2	86	Membership Organizations
Donor Services Technician	2	80	Health Services
Drill Instructor	2	83	Social Services
Echo Tech	2	80	Health Services
Environmental Tech	2	91	Executive Legislative & General
Home School Liaison	2	82	Educational Services
Quality Assurance Reviewer	2	83	Social Services
Tele Researcher	2	51	Wholesale Trade/ Nondurable Goods
Trained Consumer	2	87	Engineering & Management Services
Uniform Monogrammer	2	56	Apparel & Accessory Stores
Angio Assembler	1	38	Instruments & Related Products
Aquatic Plant Technician	1	95	Environmental Quality & Housing
Autopsy Technician	1	80	Health Services
Avian Technician	1	59	Misc Retail
Cellular Phone Installer	1	59	Misc Retail
Coder/ Analyst Medical Records	1	80	Health Services
Computer Graphics	1	73	Business Services
Computer Information Specialis	1	86	Membership Organizations
Computer Network Supporter	1	80	Health Services
Computer Operations Clerk	1	91	Executive Legislative & General
Computer Software Installer	1	73	Business Services
Computer Support Tech.	1	82	Educational Services

FLORIDA PENDING JOB TITLE	COUNT	SIC	INDUSTRY
Control	1	30	Rubber & Misc Plastics Products
Costumer II	1	79	Amusement & Recreation Services
CV Technician	1	80	Health Services
Data Analyst Specialist	1	76	Misc Repair Services
Data Base Administrator	1	27	Printing & Publishing
Data Processing Team Leader	1	80	Health Services
Data Systems Coordinator	1	80	Health Services
Donor Room Tech	1	80	Health Services
Echocard Tech	1	80	Health Services
Electronic Court Reporter	1	91	Executive Legislative & General
Environmental Officer	1	91	Executive Legislative & General
Environmental Safety Director	1	75	Auto Repair Services & Garages
Fitness Consultant	1	79	Amusement & Recreation Services
Fitness Tech	1	79	Amusement & Recreation Services
GIS Cadastralist	1	93	Finance Taxation & Monetary Policy
GIS Technician	1	91	Executive Legislative & General
Hair Replacement Technician	1	72	Personal Services
Haz-Mat Technician	1	17	Special Trade Contractors
Immunization Coordinator	1	82	Educational Services
Information Services Clerk	1	82	Educational Services
Information Systems Clerk	1	91	Executive Legislative & General
Material Fuser	1	23	Apparel & Other Textile Products
Noise Abatement Technician	1	45	Transportation by Air
Noise Technician	1	91	Executive Legislative & General
Older Worker Specialist	1	83	Social Services
PC Support Specialist	1	60	Banking
PC Technician	1	80	Health Services
Psych Specialty Technician	1	80	Health Services
Psychology Technician	1	80	Health Services
Quality Analyst	1	38	Instruments & Related Products
Quality Assurance Supervisor	1	73	Business Services

FLORIDA PENDING JOB TITLE	COUNT	SIC	INDUSTRY
Quality Auditor II	1	36	Electric & Electronic Equipment
Quality Control Operator	1	87	Engineering & Management Services
Quality Imp Analyst	1	80	Health Services
Quality Technician III	1	38	Instruments & Related Products
Simulator Instructor	1	82	Educational Services
Sound & Communication Technolo	1	82	Educational Services
Spec Imaging Technologist	1	80	Health Services
Special Procedure Technologist	1	80	Health Services
Special Procedures Technologis	1	80	Health Services
Spraycrete Technician	1	17	Special Trade Contractors
Structural Claimworker	1	15	General Building Contractors
Temp. CADD Draftsman	1	80	Health Services
Videotape Operator	1	48	Communications

Pending Job Titles Submitted by Texas Industries Listed by Frequency

TEXAS PENDING JOB TITLE	COUNT	SIC	INDUSTRY
MHMR Services Assistant	13	83	Social Services
Studio Phone Sales	11	72	Personal Services
Primary Home Care Supv	9	80	Health Services
Coding Specialist	8	80	Health Services
MHMR Services Assistant	8	80	Health Services
Modular LVN Charge	8	80	Health Services
Process Tech Trainee	8	28	Chemicals & Allied Products
MHMR Aide	7	80	Health Services
MHMR Aide	7	83	Social Services
Gift Consultant	6	59	Misc Retail
Home Health LVN	6	80	Health Services
I/E Technician	6	33	Primary Metal Industries
MHMR Specialist	6	83	Social Services
Pre Board Screener	6	73	Business Services
CAD Drafter	5	73	Business Services
CADD Drafter	5	87	Engineering & Management Services
Coding Technician I	5	80	Health Services
Learning Resources Asst	5	82	Educational Services
Mhmr Service Assistant	5	83	Social Services
MHMR Spec II	5	83	Social Services
Nuclear Medicine Technolo	5	82	Educational Services
Vet Technician	5	07	Agricultural Services
Advanced Practitioner	4	80	Health Services
Auto Cad Operator	4	87	Engineering & Management Services
CAD Drafter	4	87	Engineering & Management Services
CAD Draftsman	4	87	Engineering & Management Services
Certified Medication Aide	4	80	Health Services
Diagnostic Imaging Spec	4	80	Health Services
Drg Coder		80	Health Services

TEXAS PENDING JOB TITLE	COUNT	SIC	INDUSTRY
I/E Technician	4	28	Chemicals & Allied Products
Information/ Control Tech	4	49	Electric Gas & Sanitary Services
Instrument Control Tech	4	49	Electric Gas & Sanitary Services
LPTA I	4	80	Health Services
LVN Field Nurse	4	80	Health Services
MHMR Service Assistant	4	80	Health Services
NDE Technician	4	87	Engineering & Management Services
CE Instructor	3	82	Educational Services
Computer Network Tech	3	82	Educational Services
CSD Technician	3	50	Wholesale Trade/ Durable Goods
Home Care RN	3	80	Health Services
Home Health Nurse	3	80	Health Services
Home Health Supervisor RN	3	80	Health Services
Hospice Nurse	3	80	Health Services
Hospice RN	3	80	Health Services
I/E Drafter	3	87	Engineering & Management Services
Instrument Tech Apprent	3	17	Special Trade Contractors
Instrument/ Control Tech	3	49	Electric Gas & Sanitary Services
Instrument/ Elect Dept	3	87	Engineering & Management Services
Instrumentation Helper	3	17	Special Trade Contractors
Interperter I	3	82	Educational Services
KPS Associate	3	72	Personal Services
Laser Technician II	3	38	Instruments & Related Products
Legal Technician	3	73	Business Services
Network Distrib Serv Mgr	3	48	Communications
Phone Center Counselor	3	80	Health Services
Technical Staff Assistant	3	82	Educational Services
Vet Tech	3	07	Agricultural Services
Wafer Fab Operations Tech	3	36	Electric & Electronic Equipment
After School Care Worker	2	86	Membership Organizations
Autocad Designer	2	73	Business Services

TEXAS PENDING JOB TITLE	COUNT	SIC	INDUSTRY
Bilingual Telephone Rep	2	73	Business Services
Community Counselor	2	83	Social Services
Converting Line Operator	2	26	Paper & Allied Products
Data Acquisit/verif Tech	2	73	Business Services
Data Analysis Clerk	2	80	Health Services
Donor Procurement Tech II	2	80	Health Services
Educ Support Serv Tech II	2	82	Educational Services
Fiber Forming Oper Winder	2	32	Stone Clay & Glass Products
Haz Material Techn	2	16	Heavy Construction Contractors
Help Desk Specialist I	2	82	Educational Services
Home Health Attendant	2	83	Social Services
Hospice Home Care Nurse	2	80	Health Services
I/E Mechanic	2	28	Chemicals & Allied Products
I/E Trainee	2	28	Chemicals & Allied Products
Intergraph Drafter	2	73	Business Services
Interpreter I	2	82	Educational Services
Lube Center Technician	2	75	Auto Repair Services & Garages
LVN Home Health	2	80	Health Services
LVN Home Health Nurse	2	80	Health Services
Medical Eligibles Spec	2	83	Social Services
Medical Service Consult	2	64	Insurance Agents Brokers & Service
Medication Aide	2	80	Health Services
MHMR Serv Assistant	2	83	Social Services
MHMR Service Asst	2	83	Social Services
MHMR Services Asst	2	80	Health Services
MHMR SPEC I	2	83	Social Services
MHMR Supervisor	2	83	Social Services
Micro Computer User Spec	2	82	Educational Services
MRI Associate	2	80	Health Services
Network Engineering Mgr	2	48	Communications
Network/ Training Spec	2	82	Educational Services

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TEXAS PENDING JOB TITLE	COUNT	SIC	INDUSTRY
Nuclear Med Technologist	2	80	Health Services
Nuclear Medicine Technol	2	80	Health Services
Oven Room Technician	2	87	Engineering & Management Services
Phoner/ Political Polls	2	73	Business Services
Quality Assur Inspector	2	50	Wholesale Trade/ Durable Goods
Quality Coordinator	2	29	Petroleum & Coal Products
Quality Production Oper	2	38	Instruments & Related Products
Security Install Tech	2	17	Special Trade Contractors
System Support Specialist	2	92	Justice Public Order & Safety
Systems Clerk	2	54	Food Stores
Systems Support Spec	2	83	Social Services
Systems Support Spec II	2	16	Heavy Construction Contractors
Tech - Rt	2	80	Health Services
Telephone Advocate	2	83	Social Services
Telephone Communicator	2	72	Personal Services
Adaptive Technician Asst	1	94	Administration of Human Resources
Alarm Installer Tech	1	17	Special Trade Contractors
Anl Qual Admin	1	37	Transportation Equipment
Anl Sprs Reqd Id	1	37	Transportation Equipment
Application Developer	1	50	Wholesale Trade/ Durable Goods
Application Support	1	61	Credit Agencies Other than Banks
Applications Programmer	1	49	Electric Gas & Sanitary Services
Applications Programmer	1	64	Insurance Agents Brokers & Service
Assoc Eng Gp Plnr	1	37	Transportation Equipment
Auto CAD Operator	1	24	Lumber & Wood Products
Auto CAD Operator	1	35	Machinery Except Electrical
Auto CADD Technician	1	87	Engineering & Management Services
AUTOCAD Drafting	1	38	Instruments & Related Products
AUTOCAD Draftsman	1	87	Engineering & Management Services
Banbury Operator	1	30	Rubber & Misc Plastics Products
Bare Mill Dept/ Dept Serv	1	33	Primary Metal Industries

TEXAS PENDING JOB TITLE	COUNT	SIC	INDUSTRY
Berber Bundler	1	23	Apparel & Other Textile Products
Bio Asst Analyst	1	87	Engineering & Management Services
Bronchogenic Screen Clini	1	80	Health Services
C-Ray Technician	1	80	Health Services
CAD Design Drafter	1	73	Business Services
CAD Designer Draftsman	1	87	Engineering & Management Services
CAD Drafter	1	34	Fabricated Metal Products
CAD Drafter I	1	73	Business Services
CAD Draftsman	1	17	Special Trade Contractors
CAD Draftsman	1	35	Machinery Except Electrical
CAD Draftsman	1	50	Wholesale Trade/ Durable Goods
CAD Draftsman	1	73	Business Services
CAD Equip Spec	1	49	Electric Gas & Sanitary Services
CAD Manager	1	35	Machinery Except Electrical
CAD Oper/ Designer	1	36	Electric & Electronic Equipment
CAD Oper/ Material Receiv	1	50	Wholesale Trade/ Durable Goods
Cad Operator Drafter	1	38	Instruments & Related Products
CAD Operator/ Draftsman	1	87	Engineering & Management Services
CAD Specialist/ Draftsman	1	87	Engineering & Management Services
CADD Draftsman	1	87	Engineering & Management Services
Cardiopulmonary Tech I	1	80	Health Services
Caser Tong Operator	1	13	Oil & Gas Extraction
Cellular Coordinator	1	48	Communications
Cellular Technician	1	48	Communications
Cert Home Health Aide	1	73	Business Services
Circuit Board Designer	1	50	Wholesale Trade/ Durable Goods
Circuit Card Tester	1	35	Machinery Except Electrical
Clerk/ Veni	1	80	Health Services
Cme Technician	1	87	Engineering & Management Services
Coder/ Analyst	1	80	Health Services
Coder/ Insur Clk/ Dr Asst	1	80	Health Services

TEXAS PENDING JOB TITLE	COUNT	SIC	INDUSTRY
Computer Aided Drafting	1	87	Engineering & Management Services
Computer Aided Draftsman	1	49	Electric Gas & Sanitary Services
Computer Embroidery Machi	1	56	Apparel & Accessory Stores
Computer Network Tech	1	48	Communications
Computer Stitch Operator	1	31	Leather & Leather Products
Computer Tomograph Techno	1	80	Health Services
Computer/ Cad	1	50	Wholesale Trade/ Durable Goods
CSD Network Engineer	1	50	Wholesale Trade/ Durable Goods
Ct Scan Technologist	1	80	Health Services
Ct Scans/ Nuclear Med/ X-Ray	1	80	Health Services
Data Integrity Analyst	1	80	Health Services
Decontamination Tech	1	87	Engineering & Management Services
Demension Mill Operations	1	25	Furniture & Fixtures
Design Draftsman /CAD	1	35	Machinery Except Electrical
Designer Drafter	1	38	Instruments & Related Products
Designer/ Mgr CAD Operatio	1	87	Engineering & Management Services
Diagnostic Imaging Tech	1	80	Health Services
Drafter Auto CAD	1	87	Engineering & Management Services
Drafter/ CAD Operator	1	87	Engineering & Management Services
Draftsman/ CADD Operator	1	87	Engineering & Management Services
Draftsman/ Computer	1	35	Machinery Except Electrical
DS QI Coordinator	1	80	Health Services
Electrical CAD Technician	1	87	Engineering & Management Services
Electromechanical CAD Tec	1	87	Engineering & Management Services
Embroidery Machine Oper	1	23	Apparel & Other Textile Products
Enviromental Coordinator	1	51	Wholesale Trade/ Nondurable Goods
Enviromental Specialist	1	49	Electric Gas & Sanitary Services
Environ Tech Instructor	1	82	Educational Services
Environmental Clerk	1	28	Chemicals & Allied Products
Environmental Operator	1	42	Trucking & Warehousing
Environmental Qual Inspec	1	91	Executive Legislative & General

TEXAS PENDING JOB TITLE	COUNT	SIC	INDUSTRY
Environmental Qual Spec	1	16	Heavy Construction Contractors
Environmental/ Safety Tech	1	13	Oil & Gas Extraction
Field Paramedic	1	41	Local & Interurban Passenger Transit
Global Representative i	1	60	Banking
Glost Utility	1	32	Stone Clay & Glass Products
Habilitation Attendant	1	80	Health Services
Habilitation Trainer	1	80	Health Services
Habilitator/ Homemaker	1	83	Social Services
Home Health Field Nurse	1	80	Health Services
Homebase Education/ Coord	1	83	Social Services
Interpreter for the Deaf	1	82	Educational Services
Interpreter/ Note Taker	1	82	Educational Services
Interpreter/ Notetaker	1	82	Educational Services
Interpreter/ Tour Guide	1	86	Membership Organizations
Junior CAD Operator	1	13	Oil & Gas Extraction
LVN Apheresis Nurse	1	80	Health Services
LVN/ Field Nurse	1	80	Health Services
Magn Resonance Image Tech	1	80	Health Services
Magnetic Resonance Imagin	1	82	Educational Services
Med Imag Rad Technologist	1	80	Health Services
MH Case Manager	1	83	Social Services
MH/MR	1	83	Social Services
MHMR Serv Asst	1	83	Social Services
MHMR Serv Asst/ Workshop	1	83	Social Services
MHMR Service Asst/ Tech	1	83	Social Services
MHMR Services Asst	1	83	Social Services
MHMR Specialist	1	80	Health Services
MHMR Specialist Asst	1	80	Health Services
MHMR Specialist I	1	80	Health Services
MHMR Specialist I	1	83	Social Services
MHMR Supervisor	1	80	Health Services

TEXAS PENDING JOB TITLE	COUNT	SIC	INDUSTRY
NC Machine Operator	1	35	Machinery Except Electrical
NC Milling Mach Oper sr	1	37	Transportation Equipment
NC Operator	1	76	Misc Repair Services
NCC Controller	1	48	Communications
Network Analyst	1	35	Machinery Except Electrical
Network Cable Puller	1	50	Wholesale Trade/ Durable Goods
Network Engineer	1	17	Special Trade Contractors
Network Quality Analyst	1	63	Insurance Carriers
Network Services Tech I	1	60	Banking
Network Support Spec	1	94	Administration of Human Resources
Network Support Special	1	82	Educational Services
Network Technician	1	80	Health Services
Network Technician	1	87	Engineering & Management Services
Network Technician Engin	1	48	Communications
PC/LAN Administrator	1	73	Business Services
PC/LAN Administrator	1	79	Amusement & Recreation Services
Phone Interviewer	1	87	Engineering & Management Services
Process Control Spec	1	26	Paper & Allied Products
Process Validation Tech	1	38	Instruments & Related Products
Product Control Leader	1	13	Oil & Gas Extraction
Product Qual Assur Tech	1	35	Machinery Except Electrical
Product Quality Manager	1	23	Apparel & Other Textile Products
Product Release Supv	1	37	Transportation Equipment
Prosthetic/ Orthotic Tech	1	80	Health Services
Provider Home Health Care	1	80	Health Services
Qual Assur/ Mail/ Shipping	1	80	Health Services
Qual Assurance/ Warehouse	1	73	Business Services
Qual Control Assure Tech	1	80	Health Services
Quality Assur Nurse Coor	1	80	Health Services
Quality Assurance Coord	1	50	Wholesale Trade/ Durable Goods
Quality Assurance Inspect	1	33	Primary Metal Industries

TEXAS PENDING JOB TITLE	COUNT	SIC	INDUSTRY
Quality Assurance Rep	1	63	Insurance Carriers
Quality Assurance Review	1	63	Insurance Carriers
Quality Assurance RN	1	80	Health Services
Quality Assurance Spec	1	28	Chemicals & Allied Products
Quality Control Dept	1	61	Credit Agencies Other than Banks
Quality Control Inspect	1	38	Instruments & Related Products
Quality Control Person	1	20	Food & Kindred Products
Quality Control Proc Tech	1	33	Primary Metal Industries
Quality Control Super	1	23	Apparel & Other Textile Products
Quality Control Super	1	35	Machinery Except Electrical
Quality Control Superviso	1	26	Paper & Allied Products
Quality Control Superviso	1	30	Rubber & Misc Plastics Products
Quality Control Superviso	1	37	Transportation Equipment
Quality Control Worker	1	20	Food & Kindred Products
Quality Control/ Motor Sho	1	37	Transportation Equipment
Quality Control/ Parts Ins	1	37	Transportation Equipment
Quality Inspector B	1	37	Transportation Equipment
Quality Supervisor	1	50	Wholesale Trade/ Durable Goods
RN Primary Home Care Supe	1	80	Health Services
RN/ Branch Mgr Home Care	1	80	Health Services
RN/ Field Nurse	1	80	Health Services
Rn/ Field Staff	1	73	Business Services
RN/ Home Health	1	73	Business Services
RN/ Home Health Aide Coord	1	80	Health Services
Seismic Crew Member	1	65	Real Estate
Specialist MHMR	1	83	Social Services
Sr Quality Assurance Asst	1	28	Chemicals & Allied Products